# MONTHLY WEATHER REVIEW.

Editor: Prof. Cleveland Abbe.

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## INTRODUCTION.

The Monthly Weather Review for January, 1904, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph and mail, 167; West Indian Service, cable and mail, 4; River and Flood Service, regular 43, special river and rainfall, 190, special rainfall only, 56; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 3025; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries, also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. R. C. Lydecker, Territorial Meteorologist, Honolulu, Hawaii; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander H. M. Hodges, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José, Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; Rev. José Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Señor Enrique A. Del Monte, Director of the Meteorological Service of the Republic of Cuba.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the Review, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h$ $30^m$ west of Greenwich. The Costa Rican standard meridian is that of San José, $5^h$ $36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

## FORECASTS AND WARNINGS.

By Prof. E. B. Garriott, in charge of Forecast Division.

During the first half of the month the barometer was low over the British Isles, and on the 10th and 15th it fell below 29.00 inches over the north of Scotland. Following this period of low pressure the barometer was abnormally high over the eastern Atlantic from the 17th to the 24th. On the 26th a disturbance approached the British Isles, and by the 28th the barometer had fallen to 28.88 inches at Stornoway, Scotland. During the next twenty-four hours the center of disturbance apparently moved eastward toward the Scandinavian coast. During the 30th and 31st a storm of marked strength crossed the north part of the British Isles. In the vicinity of the Azores the barometer was comparatively low on the 1st and 2d, and 13th to 15th, and continued generally high from the 4th to 12th, and 16th to 31st. Over the western Atlantic the weather was seasonably severe, and the barometric depressions that left the American coast appeared to pass over the ocean in high latitudes. Three of these depressions may be identified with those that reached the British Isles.

In the United States the month opened with a depression of slight intensity over the southeastern slope of the Rocky Mountains. Increasing rapidly in strength, this depression crossed the Ohio Valley during the 2d, attended by heavy snow in the northeastern districts, and passed off the middle Atlantic coast by the morning of the 3d, with gales on the lower Lakes and along the middle Atlantic and New England coasts. This storm apparently passed north of the British Isles during the 7th and 8th. On the morning of the 2d storm warnings were ordered on the Atlantic coast from Savannah to Eastport, and the following special warning was sent to points in New York and New England:

> Snow will be heavy in the interior of New York and New England this afternoon and to-night, with high northeast shifting to northerly winds.

Following the passage of this storm a cold wave swept the districts east of the Rocky Mountains. The Savannah News, of January 7, comments as follows regarding the cold wave in that section:

> When the first intimation of the cold wave's approach was received at the Weather Bureau, word was at once sent to florists and they were warned to have their fires up. These were immediately started, and when the wave reached here flowers were well protected.

From the 19th to the 22d the center of the barometric disturbance moved from the middle Plateau region over the Mississippi Valley and the southern Lake region, with a marked increase in strength during the night of the 21st and the morning of the 22d. At 1 a. m. of the 22d, when the storm center was passing over the lower Ohio Valley, a tornado occurred at Moundville, Ala., killing, according to report, 37, and injuring about 100 persons.

During the 23d and 24th an area of low barometer moved southeastward along the eastern Rocky Mountain slope, followed by a cold wave that carried the temperature to 34° and

*Movements of centers of areas of high and low pressure.*

| Number. | First observed. Date. | First observed. Lat. N. | First observed. Long. W. | Last observed. Date. | Last observed. Lat. N. | Last observed. Long. W. | Path. Length. | Path. Duration. | Average velocity. Daily. | Average velocity. Hourly. |
|---|---|---|---|---|---|---|---|---|---|---|
| **High areas.** | | ° | ° | | ° | ° | *Miles.* | *Days.* | *Miles.* | *Miles.* |
| I | *31, p. m. | 54 | 108 | 6, p. m. | 38 | 79 | 2,900 | 6.0 | 483 | 20.1 |
| II | 7, p. m. | 28 | 97 | 10, a. m. | 27 | 80 | 1,100 | 2.5 | 440 | 18.3 |
| III | 9, p. m. | 48 | 86 | 12, a. m. | 49 | 64 | 1,050 | 2.5 | 420 | 17.5 |
| IV | 11, p. m. | 40 | 123 | 13, p. m. | 37 | 108 | 900 | 2.0 | 450 | 18.8 |
| V | 13, p. m. | 33 | 97 | 15, p. m. | 33 | 81 | 1,350 | 2.0 | 675 | 28.1 |
| VI | 14, p. m. | 41 | 124 | 20, p. m. | 32 | 80 | 4,550 | 6.0 | 758 | 31.6 |
| | 15, a. m. | 54 | 114 | | | | 3,400 | 5.5 | 618 | 25.8 |
| VII | 18, p. m. | 54 | 114 | 23, a. m. | 47 | 53 | 3,225 | 4.5 | 717 | 29.9 |
| VIII | 22, a. m. | 53 | 114 | 29, a. m. | 45 | 60 | 3,800 | 7.0 | 543 | 22.6 |
| IX | 22, p. m. | 32 | 95 | 26, p. m. | 46 | 60 | 2,600 | 4.0 | 650 | 27.1 |
| X | 27, a. m. | 52 | 110 | 30, p. m. | 37 | 75 | 3,325 | 3.5 | 950 | 39.6 |
| Sums | | | | | | | 28,200 | 45.5 | 6,704 | 279.4 |
| Mean of 11 paths | | | | | | | 2,564 | | 610 | 25.4 |
| Mean of 45.5 days | | | | | | | | | 620 | 25.8 |
| **Low areas.** | | | | | | | | | | |
| I | *30, p. m. | 50 | 110 | 3, p. m. | 46 | 60 | 3,700 | 4.0 | 925 | 38.5 |
| II | 6, a. m. | 54 | 114 | 10, p. m. | 48 | 58 | 3,000 | 4.5 | 667 | 27.8 |
| | 6, p. m. | 28 | 96 | | | | 2,800 | 4.0 | 700 | 29.2 |
| III | 8, p. m. | 51 | 116 | 11, p. m. | 35 | 75 | 2,675 | 3.0 | 892 | 37.2 |
| IV | 10, a. m. | 50 | 119 | 15, a. m. | 49 | 63 | 3,400 | 5.0 | 680 | 28.3 |
| | 11, a. m. | 37 | 103 | | | | 2,825 | 4.0 | 706 | 29.4 |
| V | 13, p. m. | 53 | 120 | 17, p. m. | 47 | 58 | 3,025 | 4.0 | 756 | 31.5 |
| VI | 15, a. m. | 35 | 104 | 16, a. m. | 33 | 91 | 800 | 1.0 | 800 | 33.3 |
| VII | 17, a. m. | 48 | 125 | 19, p. m. | 50 | 85 | 2,250 | 2.5 | 900 | 37.5 |
| VIII | 20, a. m. | 35 | 112 | 22, p. m. | 47 | 79 | 2,725 | 2.5 | 1,090 | 45.4 |
| IX | 23, p. m. | 49 | 122 | 27, p. m. | 47 | 57 | 4,275 | 4.0 | 1,069 | 44.5 |
| X | 29, a. m. | 54 | 109 | 31, a. m. | 31 | 92 | 2,800 | 2.0 | 1,400 | 58.3 |
| | | | | †2, a. m. | 48 | 63 | 2,625 | 4.0 | 656 | 27.3 |
| Sums | | | | | | | 36,900 | 44.5 | 11,241 | 468.2 |
| Mean of 13 paths | | | | | | | 2,839 | | 865 | 36.0 |
| Mean of 44.5 days | | | | | | | | | 829 | 34.5 |

* December. † February.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*George E. Hunt, Chief Clerk, Forecast Division.*

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36° below zero in Minnesota. This low area occupied western Texas on the morning of the 25th, and moved thence northeastward with increasing strength to the Canadian Maritime Provinces by the 27th, attended by heavy snow in the Ohio Valley and southern Lake region, and by gales on the lower Lakes and along the middle and north Atlantic coast. On the morning of the 26th the following special warning was sent to points in New York and New England:

> Heavy snow indicated for interior of New York and New England during next twenty-four hours, with high southerly shifting in New York to much colder northwest winds to-night.

The usual storm warnings were also hoisted well in advance of the gales that attended the storm. This depression apparently passed north of the British Isles during the 30th and 31st. The cold wave that followed this disturbance moved from the eastern slope of the Rocky Mountains over the Southern States and the Atlantic seaboard from the 25th to the 27th.

In connection with special frost warnings for southern California the San Francisco Call, of January 20, 1904, published the following dispatch dated Los Angeles, Cal., January 19:

> Reports to-night from correspondents stationed throughout the orange districts of southern California are to the effect that the frost this morning did little damage to the citrus crop, which is now practically ready for market. Having received special warning from the Weather Bureau, hundreds of ranchers resorted to smudging this morning and thereby removed all danger to their crops.

From the 28th to the 30th a depression advanced from the Gulf of Mexico northeastward off the Atlantic coast, attended by heavy snow from the interior of the east Gulf and South Atlantic States to New England.

During the third decade of the month the upper Ohio River reached flood stages, and dangerous ice gorges formed in the mountain streams of Pennsylvania. Accurate warnings were issued in connection with the Ohio River flood, and all interests were fully advised regarding danger from ice and flood in Pennsylvania. The Doylestown (Pa.) Republican, of January 25, remarks editorially regarding these advices as follows:

> The value of the service rendered by the Weather Bureau has been demonstrated in the last few days, when great floods threatened destruction to a vast amount of property. From the Bureau were issued warnings to the inhabitants of all the towns likely to suffer from the flood. While it was impossible to prevent damage to buildings, there was opportunity to remove merchandise and household goods to places of safety hours before the flood reached many towns. Through the Weather Bureau, the telegraph, and the press, not only the communities threatened by the flood, but business men in all sections of the State were informed not only as to present conditions, but what was likely to occur in the immediate future, all of which was of great service to the public.

### BOSTON FORECAST DISTRICT.

The month was remarkable for heavy snowstorms, gales of great violence and duration, and cold waves of almost unprecedented severity. The most severe storms were those of the 2-3d, 8-9th, and 26-27th. It is generally considered that the storm of the 2-3d was the heaviest since the disastrous hurricane of November 26-27, 1898. Winds of hurricane force, with snow, prevailed along the southern coast on the night of the 2d and the morning of the 3d. During the storm a two-masted schooner was wrecked on Point Allerton, Boston Harbor; captain and crew were saved by the United States Life-Saving Service. On the 26th, two fishing vessels, small schooners, were wrecked near Gloucester; two others went ashore there, with more or less damage, and another went ashore at South Point, near Boston. Few vessels left their berths during threatening weather, and especially when storm warnings were displayed, which accounts for the small list of casualties. The Boston Globe of January 9, in commenting on the storm of the preceding day, said that—

> Storm warnings were hoisted Thursday night and shipping throughout the New England coast was warned again yesterday, and the functions of the Bureau in this regard have once more proved of incalculable value. To its offices the shipping interests are once more indebted, as they have been innumerably in the past.

The heavy snowstorms of the month greatly retarded railroad and street car traffic and caused great additional expenses to transportation companies and to the cities. During the cold and severe storms many people were overcome and frost bitten, the hospitals were filled to overflowing, and several deaths resulted from the severe weather.

Seventeen storm warnings were issued during January, about all of which were fully justified. No storms or dangerous winds occurred without warnings.—*J. W. Smith, District Forecaster.*

### CHICAGO FORECAST DISTRICT.

A series of cold waves passed across the district during the month. The first appeared in the British Northwest Provinces on December 31, 1903, and warnings were issued on that day for the western portion of the Chicago forecast district, and extended to the eastern portion by the morning of January 2. Another cold wave, although not as extensive or severe, moved eastward during the 16th, and was rapidly followed by an area of low barometer which affected its intensity. Warnings were sent in advance to the States threatened. No other general warnings were issued, but on the 23d and the 31st warnings were issued for the extreme eastern portion of the district. There was no decided thaw except on the 20th, 21st, and 22d, which caused damaging floods in the eastern and southern portions of this forecast district. Railroads in the flooded area were advised on the 21st instant that a cold wave was approaching, which would quickly put an end to the flood conditions. No general storms occurred during the month, except the one which passed up the Ohio Valley during the 2d. The snowfall, however, was intermittent during the entire month, resulting in considerable total fall. At the close of the month

the entire district was covered by snow, excepting Kansas and the southwest portions of Missouri and Nebraska.

Winter navigation was maintained as usual on Lake Michigan, and frequent storms affected vessel interests. Advices were sent to the open ports in advance of the storms, and no casualties have been reported. Shipping, however, has suffered much from the immense amount of ice in the lake, and frequently boats have been held fast for several days at a time.—*H. J. Cox, Professor and District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

The most important features of the weather during the month were the decided falls in temperature which occurred on the 2d, 3d, 11th, 21st and 22d, 26th, and 29th, for all of which cold-wave warnings were issued. Frost and temperature warnings were issued on several dates for the benefit of the sugar and trucking interests, and they proved satisfactory to growers. High winds occurred at some points along the Gulf coast on the 2d, 3d, 20th, 21st, 22d, and 26th, for all of which timely warnings were ordered.—*I. M. Cline, District Forecaster.*

DENVER FORECAST DISTRICT.

Severe cold spells were notably absent, and but few special warnings were issued or needed. Such sharp temperature falls as occurred were local in character, and were quickly followed by mild weather. There was no interruption to railroad traffic in the mountains, and on the whole the weather conditions were favorable to live stock interests on the plains.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

December was unusually dry and January was also a month of drought. In the southern portion of the State, with the exception of rain on the 18th and 19th, the month was without precipitation. This condition in the very heart of the rainy season is unusual. In the northern portion of the State the rainfall has likewise been very light. The month began with moderate rains in the central and northern portions of the State, but these were quickly followed by cold, dry weather and heavy, low fogs.

A disturbance which appeared on the morning of January 15 moved eastward, but another disturbance on the morning of January 17 moved southward and caused general rain in California, with high southerly winds. Southeast storm warnings were displayed from San Francisco northward, and advisory messages were sent to southern ports. Both forecasts and warnings were verified. Frost warnings were issued on January 19, 20, and 21. Heavy frosts were reported at nearly all points on the 20th, 21st, and 22d.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND FORECAST DISTRICT.

From the 3d to the 17th storms frequently occurred on the north Pacific coast. Those of the 8th, 13th, and 16th were the most severe. During the storm of the 8th the steamer *Clallam*, plying between Seattle, Wash., and Victoria, B. C., was so buffeted by the waves that she sprung a leak and sank off Dungeness Spit early the next morning. Over fifty lives were lost by this disaster. An investigation as to its cause has been held by the steamboat inspectors, but their decision has not yet been made public. The fact remains, however, that storm warnings were flying in Seattle when the vessel left port, and about two hours later she entered the safe harbor at Port Townsend, where storm warnings were also displayed. The captain, however, regardless of the warnings, proceeded to sea and lost his boat and many precious lives. Storm warnings were displayed well in advance of every storm, and no other casualties occurred during the month, except a few of minor character.

On the evening of the 19th the conditions indicated much colder weather during the next twenty-four hours in the western portions of the district, and cold-wave warnings were issued to all stations. The drop in temperature, while marked and general, did not reach the zero point, except in eastern Oregon.—*E. A. Beals, District Forecaster.*

## RIVERS AND FLOODS.

The Mississippi River continued solidly frozen from its source to below the mouth of the Des Moines River. It was also frozen at Hannibal from the 3d to the 21st, inclusive, but moved out on the 22d, under the influence of the heavy rains and higher temperatures of the 20th and 21st. The ice went out on a water stage of 9.5 feet, which increased to 11 feet by the 24th. On this date a gorge formed about four miles below Hannibal, backing up the water to such an extent that it reached a stage of 12.2 feet on the Hannibal gage on the 26th, exceeding all previous January records by 1.2 feet. Warnings of the expected rise were issued on the previous day. After the 26th the water slowly receded. The mean stage of the water for the month, 7.2 feet, was a very unusual condition. In fact, the lowest stage for the month, 4.2 feet, has been exceeded but twice during the past twelve years by the highest stage of any other January. The heavy rains and high temperatures of the 20th and 21st also started the ice in the lower Des Moines River, but it was checked at its mouth by the solid Mississippi ice. This caused the usual back water, and the result was a rapid flooding, on the 22d, of the low lands on both sides of the Des Moines River.

There was also considerable increase in the thickness of the ice in January. At St. Paul it increased from 18 to 26 inches; at Dubuque, from 10 to 24 inches; and at Davenport, from 9 to 20.5 inches. The Missouri River ice increased in thickness from 14.5 to 29.5 inches at Bismarck; from 12 to 19 inches at Sioux City; and from 6 to 13 inches at Omaha. Below Omaha the usual large quantities of floating ice were observed. A little ice was observed as far south as Memphis on the 8th, but there was none of consequence until the 30th, when the heavy ice of both the Ohio and Mississippi rivers passed down, interfering with, but not totally interrupting, navigation. In the Ohio River the conditions were such as to require constant vigilance, the culmination coming with the breaking up of the large gorges in the Allegheny and Monongahela rivers on the 22d, and the 30-foot flood at Pittsburg on the 26th, which reached the mouth of the river at the end of the month. The following report of the Pittsburg flood and its antecedent conditions was prepared by Mr. Frank Ridgway, official in charge, United States Weather Bureau office, Pittsburg, Pa.

The peculiar precipitation conditions which had prevailed throughout the Allegheny and Monongahela valleys during the most of the summer and all of the fall and early winter of 1903, contributed very largely in making this one of the most interesting and singular floods in the history of high water in this locality. From about July 1, 1903, to about the middle of January, 1904, very little precipitation had occurred in the entire Monongahela Valley, so that the water in that stream had reached a very low stage, which continued until the eve of the recent flood; on the other hand, the precipitation in the Allegheny Valley and tributaries during this same period was quite general, and at times excessive, monthly rises occurring in that stream. About the middle of November, after the cold weather had set in, frequent heavy snowfalls occurred throughout the Allegheny Valley, the snow averaging from 3 to 5 feet in depth until the arrival of the moderating weather which resulted in the flood. During this same period, however, the snowfall in the Monongahela Valley was comparatively light. These general conditions necessarily determined the fact that a sudden thaw, with the absence of rain, would result in an extensive freshet out of the Allegheny River, but with comparatively little water from the other river. The unusually long period of severely cold weather resulted in the formation of extremely heavy ice, which reached a thickness of from 18 inches to 2 feet on both rivers throughout their entire length, and also on all their tributaries. In addition to the frozen condition of the stream, as above stated, there had also formed three formidable ice gorges in the lower 50 miles of the Allegheny River, due to a slight moderation on December 23, 24,

and 25. These gorges subsequently became thoroughly frozen and consolidated into huge masses in three separate places, causing the heaviest ice that has occurred in these streams for the past twenty-five years.

From the above conditions it was evident that a sudden thaw, accompanied by a considerable rainfall, would speedily move the ice out of both rivers, and it was deemed of extreme importance, therefore, that all interests that would be subjected to the ravages of ice and high water should be kept awake to the great necessity of properly guarding their property against a sudden breaking up of the ice.

The first indication of a storm that promised sufficient precipitation and rise in temperature to effect a high stage of water and a general breaking up of the ice appeared on the weather map of January 20, in the Southwest, and true to expectations it continued its movement to the northeastward, resulting in heavy rains over the entire Allegheny Valley on January 21 and 22, with an average aggregate of 1.72 inches for each station in that district. During the same time, however, only a comparatively small amount of rainfall occurred over the Monongahela Valley, averaging for the three days but 0.72 inch. Until January 20 the temperature had been moderate, but on the morning of January 21 it was sufficiently high to produce a rapid melting of the vast quantities of snow which covered the ground in this locality.

On the morning of January 21 no rises in excess of 0.5 foot were reported from any of the upper river stations. Nevertheless, on account of the heavy rains which fell during the preceding night, high temperatures, and the prospective weather conditions, it was deemed advisable to call for frequent special reports after 12 noon of that day. The conditions in the evening indicated that there was no probability of any part of the ice coming out during the night, or of high water that would necessitate the removal of goods in the low portions of the cities, and this information was freely communicated to the various interests. Nevertheless it was considered highly probable that the breaking up of the ice in the tributary streams, and in parts of the main streams, would occur during the night, and the office was therefore placed in touch with those stations which could be reached by telephone, and was kept open continuously until the regular reports came in on the following morning.

At 3:00 a. m. on January 22 information was received of a breaking up of the ice at various points along both streams for some distance above Pittsburg. This information was immediately sent out to such interests as were most concerned, and advices given to prepare for a general movement of the ice and excessive rises of water within a few hours. The regular morning reports from the upper river stations, January 22, while showing comparatively small rises, except at Freeport, on the Allegheny River, indicated heavy rainfalls during the night, which, accompanied by the high temperatures then prevailing, necessarily presaged a flood stage. These reports also indicated a general breaking up and movement of the ice throughout the Youghiogheny Valley, and it was also certain that the entire mass of ice in the Allegheny would shortly come out, and that, too, in advance of the Monongahela River ice, a condition which the oldest navigator could not recollect having previously experienced; yet the very erratic rises reported were such as to be of little value in determining the probable extent of the flood that was certain to occur.

Owing to the absolute necessity of, and the imperative demands for, immediate information as to the probable height of the water, I issued a general warning at 11:35 a. m., for a stage of 25 feet or over by evening, and also that all preparations should be made for not less than 30 feet, the final stage. Although still unsatisfactory, owing to the ice gorges all along the rivers, the afternoon special reports enabled me to determine upon a definite stage at 4 p. m., when another general warning was issued through the police departments and the press, and to all interests that could be reached by telephone and telegraph, for a maximum stage of 30 feet by noon of January 23. At the same time a warning was telegraphed to all interests at Wheeling to prepare for a stage of from 40 to 45 feet there by noon of January 24. At 7:45 a. m. a report was received from Springdale, 17 miles from Pittsburg, on the Allegheny River, that the ice was moving out with a 28-foot stage of water behind it. This ice reached Pittsburg at 9 a. m., being the heaviest ever witnessed here, and the flow continued without cessation until long after the flood had reached a maximum. Simultaneously with the approach of this ice the rivers rose rapidly, and continued to rise during the remainder of the day. In the meantime the upper Monongahela rose very slowly, yet sufficiently to bring out the ice from the 3d, 4th, and 5th pools, below which it had previously been broken up by steamboats. The ice in the Youghiogheny River also came out, accompanied by the higher water that was in the Monongahela River. Along with the excessive stage in the Allegheny, considerable backwater, together with a very sluggish current, was produced in the lower Monongahela, the difficulty being augmented by the fact that the navigation interests had placed large numbers of their loaded craft in the mouth of the Monongahela for protection against the rush of ice from the Allegheny, which they assert is the most dangerous feature with which they have to come in contact at such times. When, therefore, the Monongahela River ice reached this narrow channel about 9 p. m., it experienced so much difficulty in forcing its way out as to cause considerable damage to many of the craft moored at that point. During the nights of January 22 and 23 constant communication was maintained with all interests that would be affected by the flood. At noon of January 23 special reports from Fairmont and points farther down the Monongahela River showed that the ice from the upper Monongahela had also broken and was coming out.

The rivers reached the danger line of 22 feet at Pittsburg at 4 p. m., January 22, and the 25-foot stage at 10 p. m., continuing to rise throughout the night, so that on the morning of January 23 a stage of 28.7 feet had been reached, indicating that the predicted stage of 30 feet would be verified about the time designated. The maximum of 30 feet occurred at Pittsburg at 3 p. m., and continued until 8 p. m., when the rivers began to fall slowly.

The persistency in the rise of the Beaver River during the morning of January 23 indicated that the stage of water at Wheeling would not be less than 43 feet nor more than 45 feet, as forecast the previous day, and a second warning was accordingly telegraphed to Wheeling to this effect. The maximum stage at Wheeling was 44.2 feet at 4 p. m. of January 24, 0.8 foot below the maximum stage predicted on January 22.

The most peculiar feature of this flood was that it was produced in greater part by the lower two-thirds of the Allegheny River and its tributaries and the Youghiogheny River. The immense quantities of snow on the ground throughout the upper one-third of the Allegheny Valley evidently held the rain which fell upon it, so that, for the time being, it did not escape into the streams; on the other hand, the rain and melted snow in the Monongahela Valley were together capable of producing only a 21-foot stage at Lock No. 4. Had the rainfall been general over both valleys, or had there been sufficient snow throughout the Monongahela Valley to have produced even a 35-foot stage at Lock No. 4 (which is 7 feet below the record at that point), the record-breaking stage of 35 feet, reached in 1832, would certainly have been passed, and the damage to property, both on the river and in the lowlands, would have been difficult to estimate. Notwithstanding the amount of snow that was melted in the valley of the Allegheny and its tributaries at the time of the recent flood, there still remains, according to the best obtainable information, from 2 to 4 feet of snow over the upper valleys, and this is being added to almost daily, so that even though the heavy ice has passed out, there still exist conditions which may, at any time, cause a repetition of the high water.

At Parkersburg the height of the flood crest was 42.4 feet on January 25, and the stages in the district varied from 42 to 44 feet. Warnings were issued January 22 to the effect that the ice gorges would probably break on that day and night, and advising that preparations be made for a water stage of 45 feet. There was no flood of consequence in the Cincinnati district, but the enormous ice gorge that formed in December, 1903, and continued during January, both above and below Cincinnati, created a situation fraught with the utmost possibilities of danger and destruction, and one that could cause only the gravest apprehensions which were prolonged without the slightest relaxation for nearly six weeks. The following report of these gorges was prepared by Mr. S. S. Bassler, official in charge, United States Weather Bureau office, Cincinnati, Ohio:

While there have been in recent years considerably lower temperatures in connection with severe but short-lived cold waves, the oldest inhabitant in this section does not recall so trying, continuous, disastrous and record-breaking a season as the current winter of 1903-04. The oldest of the river men can not recall conditions like those that prevailed during the months of December, 1903, and January, 1904. The Ohio River was frozen and gorged from its source to its mouth, the stream at many places being frozen solid to the bottom. Ice of the quantity, amount, and abnormal thickness of that that filled the Ohio from bank to bank during the current winter was probably never before seen in the history of Cincinnati. The river was not only full of ice of varying thickness, but icebergs towered here and there to heights of 20 to 40 feet.

The outlook, from a business point of view, was gloomy in the extreme, and enormous losses of floating property were anticipated. There was a complete stagnation of river business and consequent suffering among communities dependent upon river traffic for supplies.

On December 6, 1903, ice began to float by in the river, but was not sufficiently heavy to interfere with navigation. With the exception of two days, the average daily temperature was considerably below the daily normal during the month. By December 14, 1903, there was heavy floating ice and low water, and navigation was suspended. On the same day a gorge was formed at Medoc bar, below the mouth of the Big Miami River. On December 15 the river at Cincinnati was rising in consequence of the gorge below, heavy ice was passing sluggishly through the harbor and new shore ice constantly forming. On the following day ponds and lakes were covered with ice about 7 inches thick, the river was gorged at various points below and above the city, and harbor boats were busy breaking up the ice in the harbor and preventing a closed river. By December 18 the harbor was frozen over, affecting the retail coal interests. On December 19 there was no change in the river situation, the gorges above and below the city being frozen solid to the bot-

tom. On the next day the minimum temperature for the first time in the month was at the melting point, there had been heavy rains during the night, the local tributaries ran out, the ice in the river began breaking up, and the gorges moved their positions.

Very little damage resulted from this partial break-up. A few days of comparatively mild weather, freezing at night and thawing during the day, kept the river conditions practically unchanged. On December 24, the second day in the month on which the temperature was above normal, mild, rainy weather with southeast to southwest winds prevailed. These conditions were hailed with delight as being favorable for rotting the ice and facilitating the removal of the menacing gorges. The gorge above gave way, the ice passed by with little damage, and the gorge below the city let go, carrying the mass of ice to Aurora, Ind., where it held fast. The gorge at Aurora broke at 3 p. m., December 25, leaving the river free of gorged ice at this point. But there was an immediate relapse to colder weather and the next day was the coldest of the month, the average temperature being 25° below the normal for the day, and the minimum of the day 2.8° above zero. The floating ice again gorged above and below the city, practically at the same points. New ice was forming and the harbor was again full of ice from the Ohio to the Kentucky shores. But rapidly following this decline in temperature there was an unaccountable rise, so that by 2 p. m., December 27, the mercury stood at 42°. Under the influence of this thawing weather the gorges, just reformed, suddenly gave way, and there was a crushing, crunching avalanche of ice, causing wreck and ruin to floating property and involving great loss to river interests. The river was a terrific sight, a seething stream of ice, grinding, crushing, and threatening the destruction of everything in its grasp. But the gorge at Medoc bar, 16 miles below the city, held fast and was very strong, ice having piled up from 15 to 20 feet in places. By December 28, the temperature having again declined, the heavy gorge below held back the great cakes and blocks of ice as well as the water, so that there was an accumulation of 10 to 12 feet of false water on the local gage. This false, or back water, was regarded and feared as a greater menace than the ice when the final break-up occurred. A sudden run out of this local excess of water, carrying great and heavy masses of ice, was expected to result in unprecedented losses.

Every precaution to save property from overwhelming losses was taken. At 5 p. m., December 28, the ice in the harbor stopped moving. In this apparently immovable mass of ice large steamers, hundreds of loaded coal barges, and many other river craft lay helpless. The gage showed a local accumulation of 22.8 feet, while the entire river above was falling, and Portsmouth, only 113 miles away, had but 11.4 feet. On December 29 there was another quick rise in temperature, sufficient to cause a gorge above Dayton, Ky., to let go at about 1.22 p. m. This caused a break of the gorge at the Southern Railroad bridge at about 1:30 p. m. The resistless force of the moving ice and a portion of the released backwater destroyed a gorge at Andersons Ferry at 2:30 p. m. The stupendous gorge at Medoc bar let go shortly after, and the crisis was past. The fear had been great that Medoc would successfully resist, and that the great gorge above the city would let go, thus overwhelming the harbor and bottoms in front of the city with ice. The stampede of ice and false water, occurring in daytime, enabled much valuable property to be saved. Still the indirect loss was enormous. By nightfall most of the ice had been carried out of the harbor, and the present danger was passed. The water fell 6.5 feet in twelve hours. During the remainder of the month the river fell and the ice moved freely.

The New Year, 1904, began with continued suspension of navigation on account of ice. As a result of the recent break-up of gorges and the rapid rush of piled-up ice and water, the banks of the river above and below the city were strewn with wrecks and barges, and steamers lay well out of water. On January 3 there was a drop in temperature to 3° above zero, and the ice in the river again gorged at Medoc bar below the city, and gorges formed above the city. The gorges were in very much the same position as those of the preceding month. River men declared the conditions unparalleled in their experience. This frozen and gorged condition of the river continued with slight changes, according to the variations in the weather. On January 18 the gorges were greater and heavier than at any time, and a gorge formed at Buena Vista which caused a fictitious stage of water at Portsmouth, adding to the seriousness of the situation at Cincinnati. Arrangements had been made with the wharf master at New Richmond, Ohio, 20 miles above the city, and with other parties nearer by to promptly inform us by long distance telephone of the beginning of the final break. Arrangements were also made with the officials of the Cincinnati Waterworks to signal by whistles, day or night, when directed by this office, the beginning of the break-up above, the signal to be taken up by the river craft imprisoned in the ice in the harbor. On January 20 a thaw was in progress, and while the gorges held firm, the top ice was softening and honeycombing. On January 21 thawing weather continued and there was more or less rain, causing a rise in the local tributaries. During the evening the gorges above made several false starts, but the great gorge at Medoc bar, below the city, was still intact at 5:30 p. m. All coal harbors, above and below the city, were notified to expect the signal soon. At 8 p. m. the message came from New Richmond that the ice there had started to move and that it was also moving at Palestine, 8 miles below. Later on word came over the telephone that gorges and fields of ice were passing by California, Ohio, 10 miles above the city. The general alarm signal was blown at 11:15 p. m. The fields and gorges and bergs of ice passed through the harbor during the rest of the night, sweeping away the ice obstructions below the city. The intense worry and strain of the river men was practically over. Losses were heavy, but much less than expected, and much floating property that had been carried away was subsequently recovered. On January 22 all the local gorges were gone and the ice was moving freely. Following the disappearance of the local gorges came a threatening rise in the upper part of the river. On Sunday, January 24, a warning was telegraphed to Point Pleasant, W. Va., that the river there would exceed the danger line (39 feet) on the following day. On the following day Point Pleasant was warned that the river there would reach 41 or 42 feet and begin falling that night. Observers at other substations were informed that the stage of water during the current rise would not reach the danger line in the district, except at Point Pleasant. The stage at Point Pleasant reached 42.5 feet at 3 a. m., January 27. The falling river left its banks and landings in extremely bad condition. The stream continued more or less full of heavy floating ice, and navigation remained suspended at the close of the month.

Below Cincinnati the stages of water were not so high, but heavy ice was abundant, with gorges at numerous places during the first three weeks of the month.

At Cairo the heavy ice necessitated a suspension of navigation from the 4th to the 10th, inclusive, and again on the last day of the month.

The ice in the rivers of New England, the Hudson and its tributaries, increased in quantity during the month, but not to an unusual extent.

About the same time that the Pittsburg flood was raging over the western extremity of Pennsylvania, the ice in the Susquehanna River, particularly in the North branch, had created a condition of affairs alarming in the extreme. The warm rains of January 22 and 23 had started the ice, which, however, soon gorged at a small distance below Wilkesbarre, in the neighborhood of Beachhaven, causing a severe flood, which reached a stage of 31 feet at Bloomsburg from the 24th to the 26th, inclusive. During the succeeding days the gorge gradually became larger and more compact, and by the 28th there was a solid gorge of ice from 15 to 25 feet in height, extending from Beachhaven almost to Sunbury, a distance of nearly 40 miles. Towns, villages, and farms were flooded; the railroad right of way on both sides of the river was covered with masses of ice and water many feet in depth, and bridges moved from their piers. The district between Catawissa and Danville was practically isolated for several days, with no hope of relief except through the possibility of greater disaster when the ice should break up and move away. Conditions were also somewhat threatening along the West branch of the Susquehana, but were not such as to cause serious apprehension. The situation is described in the following report, by Mr. E. R. Demain, official in charge United States Weather Bureau office, Harrisburg, Pa.

At the beginning of the month the Juniata was frozen over and the West branch was generally closed above the Williamsport dam. The North branch was frozen over in places before the end of December. Continued cold weather caused the river and all its tributaries to become icebound by January 5. No material changes occurred from that time until January 22, except that the ice increased gradually in thickness, being from 1 to 2 feet thick. In a few places a thickness of 3 feet was reported on January 22. The general rain and higher temperature attending the storm over the Susquehanna Valley on January 21 and 22, caused a general break-up of the ice in all streams of the system. On the morning of January 22 the conditions had become so threatening that warnings were telegraphed to all regular river stations, and mailed to the postmasters and others at about thirty of the principal river towns, advising that the ice would probably break up on January 23 or 24. The first break occurred at Clearfield, on the headwaters of the West branch late in the afternoon of January 22, and the ice passed off on a 9-foot flood. Warnings were immediately telegraphed to Lock Haven and Williamsport. The ice broke at Huntingdon, Lock Haven, and Towanda, early on the morning of the following day; at Williamsport it began to break about 8 a. m.; at Wilkesbarre at 2 p. m.; and at Selinsgrove at 5:30 p. m. At Harrisburg the break-up began at 6:50 a. m., January 24, the ice passing out quietly on 15.5 feet of water. Between 9 a. m. and 12 noon of that date the river at Harrisburg fell about 3 feet, and the flow of ice decreased to a marked extent, giving the first intimation of possible trouble

above. On the next morning it was learned that serious gorging had occurred in the North branch, beginning at Kipps Run, a short distance above Sunbury, and extending to Berwick, a distance of about twenty-four miles, causing serious damage to towns and low-lying farm lands. At Bloomsburg the ice was piled higher than the bridge on the west bank of the river, some reports giving the height as 40 feet, and a considerable part of the town was submerged. The bridge at Bloomsburg had three spans lifted up by the ice, and the first span was moved about eighteen inches down the stream. The girders of one span went out on top of the ice, together with some of the planking. The bridge has been repaired temporarily and was open for traffic on February 3, enough of the iron work to repair one side having been recovered. The highest water at Bloomsburg was 31 feet, or 2 feet above the danger line, from January 24 to 26, inclusive; it had receded to 20 feet on January 31.

At Catawissa the water registered 30 feet, or 6 inches higher than in 1865 and 3 feet above the flood of March 2, 1902. Catawissa, Bloomsburg, Espy, Rupert, and Danville were isolated from each other and from the outside world for several days, all roads being covered with ice and water. The railroad tracks were also covered with ice and water for miles north and south of Catawissa, stopping all traffic; traction service between Catawissa and Berwick was suspended for several days on account of washouts. The ice settled about 5 feet at Catawissa on January 25 and 26. At other towns in the gorged district the conditions were similar to those described at Bloomsburg and Catawissa. The loss up to January 26 was estimated by citizens in the locality at $350,000. With the exception of the settling of the ice, and the lower water, as mentioned above, the gorge remains about the same as when first formed.

Outside of the territory affected by this gorge, the only place reporting a danger stage was Wilkesbarre, where the water rose to 20.5 feet at 6 p. m., January 23, or 3.5 feet above the danger line, remaining at that height about one hour, but doing no material damage to property. Gorges were reported at a few other points, one being at Long Level, a few miles below Wrightsville, in the lower reach of the Susquehanna, but no serious damage has thus far resulted from the smaller gorges. An ice jam caused by the accumulation of ice from the river and the Sheshequin Creek, wrecked the iron county bridge at Ulster, in Bradford County, about 10 miles above Towanda. One pier in the middle of the stream went out about 8:30 a. m. on January 23, taking two spans into the river; about two hours later the pier on the Sheshequin side fell partly over, allowing one end of the third span to drop. This bridge was built by the county in 1889 at a cost of $38,800. It consisted of four spans of 234½ feet each.

The heavy blanket of snow covering the ground at the time the storm commenced absorbed a large amount of the rain which fell over the watershed of the river on January 21 and 22, and while the depth of snow was greatly diminished by the rain and high temperature, it is estimated that less than one-half of the water in the basin passed down with the flood, being held at first by the snow and later by the fall in temperature which checked the run-off. Reports at the close of January indicate that the depth of snow in the mountains of both the North and West branches was about eighteen inches and as this is probably mostly snow saturated with water and frozen solid, the amount of water that would be released by a sudden thaw would be sufficient to cause a flood equal to one that would ordinarily result from an average of from 2.50 to 3.00 inches of rainfall over the upper watershed.

There is nothing further of special interest to be recorded. There was a moderate rise in the Altamaha system, caused by the heavy rains of January 22. Ample notice was given of this rise, which proved very beneficial to the United States Engineers, rice planters, and lumbermen, who had been anxiously awaiting moderately high water.

The highest and lowest water, mean stage, and monthly range at 199 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, District Forecaster.*

## CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Service Division.

The following summaries relating to the general weather and crop conditions during January are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon voluntary reports from meteorological observers and crop correspondents, of whom there are about 3000 and 14,000, respectively:

*Alabama.*—No extremely low temperatures or excessive precipitation occurred, but frequent moderately cold spells retarded fall sown wheat and oats; some sown in December had not germinated. Frequent rains kept ground generally too wet for work, though some land was prepared for next season's staple crops; more oats to be sown. Destructive windstorm in Hale County on 22d; heavy snow in north-central counties on 28th.—*F. P. Chaffee.*

*Arizona.*—Temperatures were generally below normal, and droughty conditions prevailed most of the month. The drought was partly relieved by snowfall in the northern portion of Gila County and in a few other localities, but the situation had become very serious over most of the Territory. Plowing and seeding were retarded by dry, cold weather. Fall sown grain was not growing well; much of it had failed to germinate. Range feed was fairly plentiful, but stock water was scarce. Stock were deteriorating.—*M. E. Blystone.*

*Arkansas.*—The first and second decades were mild and pleasant; A general heavy rain, turning to snow, occurred on the 21st and 22d, and was followed by continued cold weather until the end of the month. Considerable progress was made in preparing the ground for spring crops. Small grain did fairly well. Very little cotton remained in the fields. Stock were generally thrifty. Fruit was not injured to any considerable extent by the cold weather.—*Edward B. Richards.*

*California.*—Temperature and rainfall were below normal and crop growth was slow. The low temperature was beneficial, however, to the deciduous fruit interests, as it prevented the too early development of bloom. Severe frosts were frequent, but caused no material injury to oranges or young nursery stock. In the central and northern sections grain and grass were in good condition and large crops are expected. The drought continues in southern California and crop prospects are discouraging.—*Alexander G. McAdie.*

*Colorado.*—Continued mild weather was favorable to stock, which were in good to fine condition, except over portions of the eastern foot-hills region, and in localities in the Arkansas Valley and eastern counties, where poor ranges and a scarcity of water prevailed. The dryness caused some deterioration in winter grain, previously reported deficient. Snowfall was also deficient during January; precipitation, especially on the eastern and southern watersheds, scarcely made good the loss by evaporation, and the amount of moisture stored for late irrigation is the least in many years; fortunately there is still time for sufficient snowfall to insure water for irrigation during the early part of the season. The prevailing dryness of the ground will lessen the early run-off.—*F. H. Brandenburg.*

*Florida.*—The month was colder than the normal, with an excess of precipitation over a large portion of the State, the deficiency being in the southern section. As a rule the soil was too cold for a satisfactory growth of vegetables, which were much retarded. Frosts were numerous and, in some instances, damaging to vegetables south to Dade County. General farm work was advanced, much plowing for corn being accomplished. Citrus trees were in good condition.—*A. J. Mitchell.*

*Georgia.*—The temperature was decidedly below the normal, the weather being steadily cold throughout the greater portion of the month, but not severe. The precipitation was below the normal, except in the southern section. An unusually heavy snowstorm occurred in the north on the 28th, the amounts ranging from 6 to 12 inches. Land was in good condition at the close of the month; wheat backward; oats poor. Preparatory work for new crops was well advanced in some sections.—*J. B. Marbury.*

*Idaho.*—Temperature in eastern and southern districts generally below normal; elsewhere, above. Precipitation deficient in nearly all sections, though more of the range was snow-covered than during December, resulting in poor condition of range stock in localities; condition of domestic stock good—*E. L. Wells.*

*Illinois.*—Wheat and rye in the central and northern districts were in a normal midwinter condition. In the principal wheat growing section, the southern district, the crop was very uneven. During the cold wave the fields were generally well covered with snow in all districts. Pastures and meadows had been well protected during the season, and were generally promising.—*Wm. G. Burns.*

*Indiana.*—The month was unusually cold, but the ground was covered with snow in the northern and greater portion of the central section, so that wheat did not suffer, except from inundation on bottom lands, caused by rain and melting snow during the 19th–22d, and also possibly on flat land by a coating of ice that formed about the 23d. Adverse conditions prevailed during the planting season for wheat in the southern section and a few southeastern conntles of the central section.—*W. T. Blythe.*

*Iowa.*—Month colder than usual, with slight excess of precipitation. First and second decades were favorable for stock feeding and usual farm operations. Severe storm of sleet and ice about 20th, followed by extremely low temperature, caused considerable damage to fruit trees, vines, timber, and telephone lines; also caused much inconvenience to stock feeders and some damage to fall grain, though the fields were covered with snow during period of lowest temperature.—*John R. Sage.*

*Kansas.*—Wheat was generally in good condition, and though un-

covered during the freezing weather, yet there was very little seriously injured, owing to dryness of ground. There is sufficient vitality, and with favorable weather growth will be resumed. Plowing progressed in the southwest and some barley and oats were sown.—*T. B. Jennings.*

*Kentucky.*—Temperature and precipitation below normal; snowfall light. Grain and grasses suffered from freezes. Most of the wheat was sown late, and, having made a poor start, scarcely showed on fields at the close of January. Earlier sown somewhat better. Fruit trees appeared to be in good condition. Stock doing well. Farm work backward; too dry and cold to handle tobacco or prepare seed beds.—*S. P. Gresham.*

*Louisiana.*—Weather conditions proved very favorable for agricultural interests, and preparations for spring planting were pushed vigorously. Seed cane saved for spring planting was found in good condition, and much cane was planted during the month. Fall planted cane was doing well. Winter oats continued to show a good stand. Gardens and strawberries were successfully protected through freezing weather. The orange crop was good.—*I. M. Cline.*

*Maryland and Delaware.*—The month was remarkable for very low temperatures on the 5th and 6th and for continuous cold, relieved by but one period, of three or four days, with temperatures above normal. Ice in harbors seriously obstructed navigation nearly all the month. Warm rains from the 20th to 24th melted all snow, caused high waters, and exposed wheat and grasses for a week. Wheat showed slight improvement, except in southern districts, where protection was inadequate. No damage to fruit reported, except in Garrett County.—*Oliver L. Fassig.*

*Michigan.*—Although January was a very cold month, with some severe cold waves, winter wheat was splendidly protected by snow during the entire month. A careful investigation by some correspondents showed wheat to be in fine condition at the close of the month and making good winter growth.—*C. F. Schneider.*

*Minnesota.*—January was a cold month, with lowest temperatures from the 1st to the 4th and from the 23d to the close. The precipitation was all snow; it fell on many days and covered the ground all month to depths ranging from about 3 inches in the southwestern to 15 or 20 inches in the northeastern portions. It was said that the season had been a very favorable one for work in the lumber regions.—*T. S. Outram.*

*Mississippi.*—The month was unusually dry, with much sunshine and considerable freezing weather. A severe thunderstorm occurred on the 21st, and a very heavy snow fell over the central and southern portions of the State on the 27th and 28th. The soil was generally in good condition and some plowing was done. Clearing the land, ditching, fencing, and hauling fertilizer were in progress. A small acreage of oats was sown. The scarcity of labor was general.—*W. S. Belden.*

*Missouri.*—Up to the 25th winter wheat received but little protection from snow, and in many localities was considerably injured by dry freezing and by alternate freezing and thawing, but during the severe cold weather of the last week of the month the crop was fairly well protected in most sections. A large portion of the peach buds were killed by the low temperatures of the 3d, 26th, and 29th.—*A. E. Hackett.*

*Montana.*—The temperature was very generally above the normal, except in the northeastern part of the State; in the western and southeastern counties the temperature was uniform for the season. In Chouteau and eastern Teton counties the precipitation was quite light, elsewhere it was somewhat above normal; the greater portion occurred during the latter part of the month. On the stock ranges there was but little severe weather, and, generally, stock had wintered thus far with practically no losses.—*Montrose W. Hayes.*

*Nebraska.*—The first twenty days were warm, with very little snow, leaving the ground practically uncovered. A favorable period for fall work on the farm, but rather unfavorable for winter wheat, although the crop was not materially injured. On the 20th, rain and sleet followed by snow, fell in the southeastern section, and during the last ten days low temperature and cloudy weather with light snow occurred generally in the State. The moisture was beneficial to wheat, but more moisture was needed, especially in central and western counties.—*G. A. Loveland.*

*Nevada.*—Temperature about normal; precipitation considerably below normal; very dry month, especially over the southern half of the State. Storms during the first half of the month improved range conditions very materially; cattle, horses, and sheep in satisfactory condition generally. Weather unusually clear and bright the last decade of the month.—*J. H. Smith.*

*New England.*—January was unusually cold throughout the district, and in many localities the coldest for many years. The precipitation, generally snow, was somewhat deficient in northern sections, and normal to heavy in the southern portion of the district. The very low temperature combined with much stormy weather, was unfavorable to outdoor pursuits. It is believed that the peach crop suffered severely from the extreme cold. The deep snow on the ground was favorable to grass and grain.—*J. W. Smith.*

*New Jersey.*—Intensely cold weather prevailed from the 2d to the 6th, inclusive, during which time the temperature fell to 34° below zero in portions of the northeastern section and to 30° below in the extreme northwestern section. The cold-wave was preceded by snow, affording ample protection to grain and grass. Many peach and plum buds were killed by the severe cold.—*Edward W. McGann.*

*New Mexico.*—The driest winter thus far for years. Since last September the precipitation had been practically nothing over the plains, excepting in the extreme northwest, and on mountain ranges much less than usual. Streams carried much less water than usual at this season. Range food, although short, was extremely well cured in the fall, and, owing to the absence of severe weather, stock continued in very good condition.—*R. M. Hardinge.*

*New York.*—January was a cold and stormy month, with much snow and practically no thawing. The weather was generally favorable for grass, wheat, and rye, which were in good condition, being covered with heavy snow in nearly all sections. Reports indicated some damage to peach trees by abnormally low and severe temperatures, the winter thus far having been the coldest for years. The ice harvest was mostly completed by January 31.—*R. G. Allen.*

*North Carolina.*—January was very cold, with the temperature almost continuously below normal. The precipitation was deficient, but became more abundant and beneficial after the 20th. Winter wheat and oats made almost no growth and were generally in poor condition. Much winter wheat failed to sprout, and evidently perished; winter oats also were badly winter killed. Almost no farm work of any kind was done during the month, except a little plowing for truck crops in the southeast portion.—*C. F. von Herrmann.*

*North Dakota.*—In the Missouri Valley and slope, where the ground was well covered with snow, feeding of all stock was necessary during the entire month, and as the supply of feed was limited, stock were in only fair condition. While considerable snow fell on the open ranges in the western part of the State, it was so drifted by high winds that stock could still graze and consequently were in fair winter condition.—*B. H. Bronson.*

*Ohio.*—Wheat was generally well protected by snow except in the extreme southern counties, and, except in that section, it was not injured by cold weather. There were no reports of injury by alternate freezing and thawing. Early sown wheat continued in fair to good condition in most sections. Late sown was fair in the north and poor in the south. The rain and warm weather of the 20th to 22d enabled tobacco growers to prepare their product for market.—*J. Warren Smith.*

*Oklahoma and Indian Territories.*—Sleet and snow of the 20th to 22d benefited wheat and placed soil in good condition for plowing and seeding; wheat small, but healthy and in fair to good condition, except over the northwestern counties and Indian Territory, where the crop was generally poor; plowing progressed rapidly; stock in good condition and wintering well.—*Charles A. Hyle.*

*Oregon.*—January was both drier and warmer than usual in all parts of the State. The top soil was well saturated with moisture, and as it was not cold enough to injure fall wheat the plant appeared to be in a thrifty and promising condition everywhere. Some plowing and seeding were done during the month, and the farmers had their winter's work well in hand. Fruit trees so far had wintered well.—*Edward A. Beals.*

*Pennsylvania.*—Some damage by washouts and floods resulted from rains of week ending 23d. Otherwise grain was well protected by snow and apparently uninjured to any great extent. At the end of the month some lowlands were covered with ice, which may prove damaging.—*T. F. Townsend.*

*Porto Rico.*—Weather dry in southern division; elsewhere frequent showers kept land and crops in good condition generally. Sugar making was general and active after first decade; yield fair for the season. Young canes and ratoons doing nicely. Coffee trees were in good condition and had begun to blossom in a few places. The sowing, transplanting, and cutting of tobacco progressed during the month; early crop good. Young plants looked well. Some beans, corn, and sweet potatoes harvested and much land prepared for spring planting. Small crops and fruits generally plentiful. Pasturage became poor.—*E. C. Thompson.*

*South Carolina.*—The month was cold, with slightly deficient, but evenly distributed precipitation. During the last four days winter grain had snow protection over the western third of the State. December sown wheat came up to thin stands. Some winter oats were sown. Oats were unusually small, though not materially injured by the alternate freezing and thawing. It was too cold for growth of either grain or truck crops. Some plowing was done preparatory to sowing spring oats and planting corn and cotton.—*J. W. Bauer.*

*South Dakota.*—Except that severe cold prevailed during the third decade, the conditions were not unfavorable. The snowfall was mostly light, but winter rye and also the very limited amount of winter wheat sown were fairly well protected thereby and were considered uninjured, except possibly in some extreme southeastern localities. Range live stock generally withstood the cold weather favorably, and at the end of the month were reported in good winter condition, but the cold necessitated heavier feeding of housed stock than usual.—*S. W. Glenn.*

*Tennessee.*—Continued low temperature, with deficient precipitation and little or no snow protection until the last week, in addition to almost continuous freezing and slight surface thawing, proved very injurious to winter grains, and prospects were worse than for many years. Where wheat was well planted early with drill, or deeply covered, the plant looked fairly well, but in many places the stands were so poor the land will be plowed up for other crops. Oats were mostly winter killed.—*H. C. Bate.*

*Texas.*—Sufficient showers fell in the coast region and the eastern por-

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

*Summary of temperature and precipitation by sections, January, 1904.*

| Section. | Temperature—in degrees Fahrenheit. | | | | | | | | Precipitation—in inches and hundredths. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Section average. | Departure from the normal. | Monthly extremes. | | | | | | Section average. | Departure from the normal. | Greatest monthly. | | Least monthly. | |
| | | | Station. | Highest. | Date. | Station. | Lowest. | Date. | | | Station. | Amount. | Station. | Amount. |
| Alabama | 41.8 | −3.2 | Flomaton | 73 | 2 | Riverton | 9 | 27 | 4.17 | −0.56 | Calera | 6.40 | Decatur | 1.90 |
| Arizona | 42.4 | −2.3 | Tombstone | 84 | 14 | Fort Defiance | −7 | 26 | 0.19 | −0.82 | Fort Apache | 0.80 | 7 stations | 0.00 |
| Arkansas | 38.9 | −1.4 | Prescott | 75 | 20 | Oregon | −5 | 26 | 3.82 | −0.76 | Pond | 6.56 | Brinkley | 2.11 |
| California | 45.8 | −0.4 | El Cajon | 88 | 13 | Bodie | −14 | 18 | 1.38 | −2.88 | Branscomb | 8.61 | 7 stations | 0.00 |
| Colorado | 22.9 | −1.3 | Holly, Blaine | 74 | 18 | Gunnison | −30 | 28 | 0.35 | −0.28 | Ruby | 2.92 | 4 stations | 0.00 |
| Florida | 54.9 | −2.1 | Orange Home | 88 | 22 | Molino | 20 | 5, 6 | 5.20 | +2.54 | Gainesville | 11.79 | Plant City | 1.20 |
| Georgia | 41.8 | −3.5 | St. Marys | 76 | 22 | Clayton | 4 | 30 | 3.91 | −0.35 | St. Marys | 6.92 | Waynesboro | 0.86 |
| Idaho | 24.7 | ....... | Gamet | 60 | 16 | Chesterfield | −24 | 23 | 1.52 | ....... | Murray | 4.39 | Gamet | 0.12 |
| Illinois | 20.8 | −5.4 | Cairo | 61 | 20 | Antioch<br>Flora | −25<br>−25 | 4, 25<br>27 | 2.95 | +0.68 | La Harpe | 5.48 | Antioch | 0.55 |
| Indiana | 21.7 | −5.7 | Crawfordsville | 64 | 19 | Hector, Richmond | −26 | 3 | 4.15 | +1.26 | Kokomo | 7.26 | Crawfordsville | 1.61 |
| Iowa | 14.0 | −4.2 | Red Oak | 57 | 19 | Elkader, Fayette | −32 | 27 | 1.18 | +0.21 | Lacona | 3.68 | Storm Lake | 0.02 |
| Kansas | 29.3 | −0.4 | Medicine Lodge | 72 | 19 | Marion | −19 | 26 | 0.51 | −0.30 | Pleasanton | 2.13 | Oberlin | 0.00 |
| Kentucky | 32.3 | −2.4 | Jackson | 70 | 22 | Fords Ferry | −9 | 27 | 3.17 | −0.73 | Blandville | 5.16 | Lexington | 1.92 |
| Louisiana | 48.0 | −2.8 | Melville | 80 | 1 | Leesville | 10 | 4 | 2.92 | −1.78 | Donaldsonville | 4.58 | Lake Charles | 1.25 |
| Maryland and Delaware | 25.5 | −5.7 | Charlotte Hall, Md. | 64 | 22 | Grantsville, Md | −20 | 5 | 2.53 | −0.60 | Bachman's Valley, Md. | 4.67 | Pocomoke City, Md. | 1.07 |
| Michigan | 13.0 | −7.9 | Detroit, Hagar,<br>Birmingham | 42<br>42 | 20<br>21 | Humboldt | −41 | 29 | 2.06 | −0.09 | Dundee | 5.37 | Menominee | 0.35 |
| Minnesota | 4.5 | −4.8 | Winnebago City | 43 | 9 | Pokegema Falls | −57 | 24 | 0.39 | −0.31 | New Ulm, Shakopee | 1.00 | Pine River Dam | 0.08 |
| Mississippi | 42.9 | −3.3 | Magee | 79 | 10 | Jackson | 3 | 30 | 3.16 | −2.05 | Indianola | 5.42 | Thornton | 1.60 |
| Missouri | 27.0 | −2.6 | Dean, Mt. Vernon,<br>Protem | 66<br>66 | 20<br>15 | Sublett | −23 | 29 | 2.85 | +0.86 | Neosho, New Madrid | 5.29 | Kansas City | 0.77 |
| Montana | 23.4 | +4.6 | Billings | 58 | 15 | Culbertson | −34 | 25 | 0.89 | +0.17 | Columbia Falls | 3.13 | Hamilton | 0.07 |
| Nebraska | 23.1 | +0.1 | Kimball | 73 | 14 | Agate | −27 | 28 | 0.35 | −0.12 | Auburn | 2.29 | Smithfield | 0.00 |
| Nevada | 27.4 | −0.1 | Martins' Ranch | 71 | 14 | Elko | −22 | 20 | 0.53 | −0.78 | Lewis Rand | 2.28 | 2 stations | 0.00 |
| New England* | 15.0 | −6.7 | Woodstock, Vt. | 55 | 27 | Enosburg Falls, Vt | −44 | 19 | 3.76 | −0.12 | Rockport, Mass | 6.90 | Block Island, R. I | 1.66 |
| New Jersey | 23.2 | −6.8 | River Vale | 59 | 23 | River Vale | −34 | 5 | 3.09 | −0.63 | Dover | 4.67 | Tuckerton | 1.34 |
| New Mexico | 31.9 | −0.9 | Carlsbad | 77 | 18 | Fruitland | −9 | 28 | 0.17 | −0.39 | Cloudcroft | 0.85 | 2 stations | 0.00 |
| New York | 15.0 | −7.4 | New York | 55 | 23 | Paul Smiths | −46 | 19 | 3.48 | +0.61 | Adams Center | 6.52 | Harkness | 1.48 |
| North Carolina | 36.0 | −4.2 | Fayetteville | 73 | 22 | Highlands, Hendersonville. | −8 | 30 | 2.95 | −1.24 | Highlands | 6.07 | Charlotte | 1.38 |
| North Dakota | 3.6 | −3.0 | Oakdale | 50 | 9 | Milton | −52 | 24 | 0.37 | −0.14 | Glen Ullin | 1.10 | 2 stations | T. |
| Ohio | 20.7 | −7.1 | Cambridge | 70 | 22 | Milligan | −30 | 4 | 3.85 | +1.30 | Benton Ridge | 7.23 | Pomeroy | 1.50 |
| Oklahoma and Indian Territories. | 36.5 | −0.9 | Eldorado, Okla | 79 | 19 | Arapaho, Okla | −5 | 26 | 1.50 | +0.12 | Claremore, Ind. T | 9.00 | 2 stations | T. |
| Oregon | 37.0 | +1.9 | Gold Beach | 73 | 30 | Pine | −11 | 20 | 5.27 | −0.58 | Glenora | 21.20 | Grass Valley | 0.15 |
| Pennsylvania | 20.0 | −7.3 | Pittsb'rg, Uniontown | 66 | 22 | Lawrenceville | −38 | 4 | 3.55 | −0.32 | Somerset | 5.82 | Greensboro | 2.08 |
| Porto Rico | 73.3 | ....... | Bayamon | 95 | 24 | Cidra | 47 | 20 | 3.19 | ....... | Cidra | 9.31 | Ponce | 0.05 |
| South Carolina | 40.2 | −4.5 | Yemassee | 74 | 21 | Clemson College<br>Darlington | 8<br>8 | 5<br>6 | 2.97 | −0.59 | Summerville | 4.78 | Bennettsville | 0.82 |
| South Dakota | 12.3 | −2.5 | Cavite | 68 | 7 | Kidder | −39 | 24 | 0.29 | −0.17 | Silver City | 1.60 | 2 stations | T. |
| Tennessee | 36.1 | −1.7 | Newport | 71 | 22 | Bristol<br>Erasmus<br>Rugby | 3<br>3<br>3 | 30<br>27<br>5 | 3.35 | −1.60 | Trenton | 5.05 | Carthage | 1.49 |
| Texas | 46.9 | −1.1 | Fort Ringgold | 91 | 22 | Menardville | 1 | 29 | 0.71 | −1.41 | Sabine | 3.29 | 15 stations | 0.00 |
| Utah | 23.3 | −3.5 | Rockville | 68 | 17 | Plateau | −23 | 26 | 0.83 | −0.08 | Tooele | 2.82 | 2 stations | 0.00 |
| Virginia | 31.0 | −4.4 | Newport News | 70 | 22 | Burkes Garden | −14 | 30 | 2.33 | −0.72 | Standardville | 4.27 | Shenandoah | 1.37 |
| Washington | 34.9 | +3.2 | Mottinger's Ranch | 61 | 12 | Republic | −10 | 20 | 3.99 | −0.28 | Clearwater | 16.77 | Ephrata | 0.15 |
| West Virginia | 27.5 | −4.3 | Logan<br>Williamson | 72<br>72 | 29<br>23 | New Cumberland | −18 | 5 | 2.72 | −0.94 | Pickens | 5.82 | Parkersburg | 1.24 |
| Wisconsin | 8.1 | −6.9 | Prairie du Chien | 47 | 9 | Minocqua<br>Osceola | −46<br>−46 | 27<br>25 | 0.50 | −0.71 | Beloit | 1.83 | Meadow Valley | 0.08 |
| Wyoming | 20.1 | +0.1 | Pine Bluff | 63 | 15 | Border | −24 | 31 | 0.79 | +0.03 | Battle | 8.30 | 2 stations | T. |

* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

tion of the State, and the drought in the northern portion was broken by the rainfall of the 20th and 21st. A cold wave overspread the State on the 3d and 4th and another on the 25th. Wheat, barley, rye, and fall oats were very backward in all sections as a result of the drought. These crops were improved in the northern portion by the rainfall of the latter part of the month. West of the Brazos River small grain was in very poor condition. Preparation of ground for spring crops was unusually well advanced. Truck in the coast region was somewhat damaged by low temperatures. Range feed was short, but stock were generally in fair condition.—*L. H. Murdoch.*

*Utah.*—Cold, stormy weather prevailed, except over the southern counties. Abundant snowfall over the northern portion of the State, with only a trace over the southern portion. The range afforded practically no feed. Stock were being fed and were thriving. Feed was reported scarce. Wheat was well protected and in excellent condition in the districts where most of the wheat is grown, but, owing to drought and scanty snow covering in the southern half of the State, the crop there was much less promising.—*R. J. Hyatt.*

*Virginia.*—Temperature and precipitation were below normal. During short periods in the second and last decades thawing injured late sown wheat, oats, and clover. A heavy snowfall in the last decade protected these crops during the coldest weather. In nearly all grain growing sections the winter wheat and oats, also rye and clover, were in a precarious condition and it seemed certain that the acreage would be much reduced from this cause.—*Edward A. Evans.*

*Washington.*—The precipitation was ample and, as a rule, well distributed both as to time and locality. It should be beneficial to the staple crops of the ensuing season by storing up a supply of moisture in the soil. The temperature was remarkably uniform, and much milder than usual in the eastern counties of the eastern division. The weather was generally favorable for the growth and healthful condition of winter wheat. There was no injury from freezing.—*G. N. Salisbury.*

*West Virginia.*—The weather during the month was cold and dry. Rain caused general break-up on the 22d, and replenished water supply. Wheat, rye, oats, and grass in poor condition, not having had much snow protection over a large part of State. No plowing or other farm work done. Some corn remained to be husked. Roads in fine condition, and stock wintering well.—*E. C. Vose.*

*Wisconsin.*—The month was generally dry and cold. The most severe cold period lasted from the 24th to the 29th, the 25th giving an average temperature for the State of 18.2° below zero. Although the snowfall was light there was little melting, and winter grain and grasses were amply protected from the cold weather throughout the month. A large portion of the tobacco crop remained in the shed, as the weather was too dry to allow of handling the crop without waste.—*W. M. Wilson.*

*Wyoming.*—The weather for the month was mild and pleasant over nearly all sections of the State, and unusually favorable for the stock interests. All stock have kept in good condition, and practically no losses have occurred. The deficient snowfall over most of the State gave some apprehension of a deficient supply of irrigation water for the coming season.—*W. S. Palmer.*

## SPECIAL ARTICLES.

### RECENT PAPERS BEARING ON METEOROLOGY.

Dr. W. F. R. PHILLIPS, Librarian, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——.

*Scientific American. New York. Vol. 90.*
—— Dispersion of Fogs by Electricity. P. 115.
*Scientific American Supplement. New York. Vol. 57.*
—— Electrons and Atmospheric Electricity. P. 23522.
*Aeronautical Journal. London. Vol. 8.*
**Bryan, G. H. and Williams, W. E.** The Longitudinal Stability of Aeroplane Gliders. Pp. 12-19.
**Marriott, William.** The Balloon Ascents made by James Glaisher, F. R. S., for Scientific Purposes, 1862-69. Pp. 19-23.
*Symons's Meteorological Magazine. London. Vol. 38.*
**C., R. H.** An Unexpected Use for Sunshine Recorders. Pp. 210-211.
**Smith, C. Michie.** The Climate of Kodaikánal. Pp. 215-217.
*Smithsonian Miscellaneous Collections. Washington. Vol. 45.*
**Abbot, C. G.** Recent Studies of the Solar Constant of Radiation. Pp. 74-83.
*American Journal of Science. New Haven. 4th Series. Vol. 17.*
**Bumstead, H. A. and Wheeler, L. P.** Properties of a Radioactive Gas found in the Soil and Water near New Haven. Pp. 97-111.
*London, Edinburgh, and Dublin Philosophical Magazine. London. Vol. 7.*
**Allan, S. J.** Radioactivity of the Atmosphere. Pp. 140-150.
*Nature. London. Vol. 69.*
**Blythswood, Lord and Allen, H. S.** Radio-active Gas in Mineral Springs. P. 247.
**Stoney, G. Johnstone Stoney.** Escape of Gases from Atmospheres. Pp. 247-248.
—— Atmospheric Absorption and Emission of the Extreme Ultra-Violet Radiation. P. 262.
**Simpson, George.** A Theory of the Cause of Atmospheric Electricity. P. 270.
**Clayton, Henry Helm.** The Diminishing Size of the New Bishop's Ring around the Sun. Pp. 270-271.
**Lodge, Oliver.** Atmospheric Electricity. P. 294.
**Warner, H. M.** Curious Shadow Effects. P. 296.
—— Observations of Glaciers and Avalanches. P. 299-300.
**Lockyer, Norman J.** Simultaneous Solar and Terrestrial Changes. Pp. 351-357.
*La Géographie. Paris. Vol. 8.*
—— Géographie et météorologie au Congrès de l'Association française pour l'Avancement des Sciences. Pp. 98-100.
**Charrol, Marcel.** L'état anémométrique du bassin occidental de la Méditerranée. Pp. 199-207.
**Lalot, L.** Action de la fusion de la glace sur la circulation océanique. Pp. 333-335.
*Journal de Physique. Paris. 4me séries. Tome 2.*
**Beaulard, F.** Sur l'ionisation de l'air produite par une pointe électrisée. [Review of article of A. Righi.] Pp. 909-913.
*Journal de Physique. Paris. 4me série. Tome 3.*
**Nordmann, Ch.** Le rayonnement hertzien du soleil et l'influence de l'activité solaire sur le magnétisme terrestre. Pp. 97-120.
*Annales de Géographie. Paris. 13me année.*
**Brunhes, Bernard and Brunhes, Jean.** Les analogies des tourbillons atmosphériques et des tourbillons des cours d'eau et la question de la déviation des rivières vers la droite. Pp. 1-20.
**Sorre, Maximilian.** Régime pluviométrique de la Vendée. Pp. 56-63.
*Comptes Rendus de l'Académie des Sciences. Paris. Tome 138.*
**Teisserenc de Bort, L.** Sur la décroissance de température avec la hauteur dans la région de Paris d'après 5 années d'observations. Pp. 42-45.
**Guillaume, J.** Observations du soleil faits à l'Observatoire de Lyon (équatorial de 0.16) pendant le troisième trimestre de 1903. Pp. 254-255.
**Gorczynski, Ladislas.** Sur la diminution de l'intensité du rayonnement solaire en 1902 et 1903. Pp. 255-258.

*Archives des Sciences Physiques et Naturelles. Genève. 4me période. Tome 16.*
**Gautier, R.** Résumé météorologique de l'année 1902 pour Genève et le Grand Saint-Bernard. Pp. 702-730.
*Archives des Sciences Physiques et Naturelles. Genève. 4me Période. Tome 17.*
**Elster, J. and Geitel, H.** Sur la radioactivité de l'atmosphère et du sol. Pp. 5-22.
**Gockel, Albert.** Sur la variation diurne de la déperdition de l'électricité dans l'atmosphère. Pp. 93-100.
*Bulletin de la Société Belge d'Astronomie. Bruxelles. 9me année.*
**Arctowski, Henryk.** Les observation météorologiques de l'expédition du "Gauss." Pp. 13-17.
**V., J.** Trombes. [Note on observations of Ed. Bogaert.] Pp. 19-21.
*Annuaire de la Société Météorologique de France. Paris. 52me année.*
**Moureaux, Th.** Application des sels radium à l'étude de l'électricité atmosphérique. Pp. 9-11.
**Cirera, P.** Rapport succint sur l'Observatoire de l'Ebre. Pp. 11-14.
**Dechevrens, Marc.** Sur quelques variations intéressantes de la température en Europe, les 3 et 4 décembre 1903. Pp. 14-17.
*Ciel et Terre. Bruxelles. 24me année.*
—— Mammato-cirrus. [Note on observations of Bracke.] Pp. 513-514.
—— Constitution physique de l'atmosphère. Pp. 515-516.
—— Le point le plus froid du globe. P. 516.
**P., W.** Pluie de poussière volcanique. [Note.] Pp. 516-517.
**Rotch, A. L.** Les sondages de l'atmosphère au-dessus des océans equatoriaux. Pp. 517-518.
**Van der Mensbrugge, G.** Une "Triple Alliance" naturelle. Pp. 519-529; 545-552.
**L., V. D.** Les anomalies climatériques de l'Islande comparées aux anomalies concomitantes du nord-ouest et du centre de l'Europe. P. 566-567.
*La Nature. Paris. 32me année.*
**Touchet, Em.** La forme et la structure de l'éclair. Pp. 138-140.
*Gaea. Leipzig. 40 Jahrgang.*
—— Die periodischen Schwankungen der Sonnenflecken und der Niederschläge. Pp. 65-75.
—— Die klimatischen Verhältnisse von Pará. Pp. 89-92.
**Spiess, Otto.** Zur Flugfrage. Pp. 101-108.
—— Der Sturm von 21 November. Pp. 116-117.
*Das Weltall. Berlin. 4 Jahrgang.*
**Hepner, Heinrich.** Wie eklärt sich die Witterung des Sommers 1903. Pp. 145-147.
—— Einige Versuche über Elektrizitätszerstreuung in Luft. [Review of article of R. Börnstein.] P. 177.
*Das Wetter. Berlin. 21 Jahrgang.*
**Elias, H.** Der Zustand der Atmosphäre an Nebeltagen. Pp. 1-11.
**Arendt, Th.** Die Abhängigkeit des Grundwasserstandes. Pp. 11-18.
*Annalen der Hydrographie und Maritimen Meteorologie. Berlin. 32 Jahrgang.*
**Brennecke, Wilhelm.** Beziehungen zwischen der Luftdruckverteilung und den Eisverhältnissen des Ostgrönländischen Meeres. Pp. 49-62.
**Schwalbe, G.** Der Schneesturm vom 18 bis 20 April 1903 in Ostdeutschland. Pp. 62-69.
—— Die Witterung zu Tsingtau im Juni, Juli und August, 1903, mebst einer Zusammenstellung für den Sommer 1903. Pp. 69-74.
**Stach, E.** Ueber Mitwindbestimmung bei Anemometer-Prüfungen. Pp. 74-78.
*Physikalische Zeitschrift. Leipzig. 4 Jahrgang.*
**Stuchey, C.** Ueber Geschichte Entladung im Wasserstoff bei Atmosphärendruck. P. 871.
*Physikalische Zeitschrift. Leipzig. 5 Jahrgang.*
**Elster, J. und Geitel, H.** Ueber die radioaktive Substanz, deren Emanation in der Bodenluft und der Atmosphäre enthalten ist. Pp. 11-20.
**Börnstein, R.** Einige Versuche über Elektrizitätszerstreuung in Luft. Pp. 20-25.
*Berichte über Land und Forstwirtschaft in Deutsch-Ostafrika. Heidelberg. 1 Band.*
**Uhlig, Carl.** Regenmessungen aus Usambara. Pp. 467-471.
*Geographische Zeitschrift. Leipzig. 10 Jahrgang.*
**Greim, G.** Ueber die allgemeine Zirkulation der Atmosphäre. Pp. 39-48.
*Petermanns Mitteilungen. Gotha. Band 49.*
**Hann, J.** Zum Klima des Hochlandes von Peru und Bolivia. Pp. 280-282.
*Meteorologische Zeitschrift. Wien. Band 19.*
**Meinardus, W.** Ueber die absolute Bewegung der Luft in fortschreitenden Zyklonen. Pp. 529-544.

**Trabert, W.** Die Theorie der täglichen Luftdruckschwankung von Margules und die tägliche Oszillation der Luftmassen. Pp. 544–563.
**Mazelle, Ed.** Die II. internationale Seismologische Konferenz zu Strassburg i. e. Pp. 563–564.
**Quervain, A. de.** Messung von Eigenbewegungen im Cirrostratusschirm einer Gewitterwolke. Pp. 564–565.
**Schwalbe, G.** Stresnewsky B.: Einige geometrische Zätze über die Krümmung eines Luftstromes in atmosphärischen Wirbeln. Pp. 565–566.
**H[ann], J[ulius].** Raoult Gautier und H. Dualme über die Eismänner. Pp. 566–567.
**H[ann], J[ulius].** E. de Martonne über ein 2. nachtliches Temperaturmaximum. Pp. 567–568.
—— Variation der atmosphärischen Absorption. P. 568.
—— Ozonisierung der Luft. P. 568.
**Laska, W.** Ueber eine merkwürdige Dämmerungserscheinung. Pp. 568–569.
**Raimann, E.** Ring um die Sonne und Purpurlicht, beobachtet zu Hirschberg in Schlesien. Pp. 569–570.
**Höhr, Adolf.** Zwei merkwürdige Kugelblitzerscheinungen. Pp. 570–571.
**Ebell, Martin.** Akustische Meteorologie. Pp. 571–572.
**Tein, Max v.** Ueber die Beziehungen zwischen Niederschlag und Abfluss im Maingebiete. P. 572.
—— Regenfall in London. Pp. 572–573.
—— Grosse Regenmengen in kurzer Zeit in England. P. 573.
—— Gewitter und Stürme in der Nacht vom 21. zum 22. November. Pp. 573–574.
—— Sturm Ueberschwemmung in St. Petersburg am 25. November. Pp. 574–575.

*Boletim da Sociedade de Geographia de Lisboa. Lisboa. 21me Série.*
**Berthoud, Paul.** Meteorologia de Lourenço. Pp. 306–308.

## PROBLEMS OF THE ATMOSPHERE.

By Prof. JAMES DEWAR.

In the Proceedings of the Royal Institution of Great Britain, vol. 17, part 1, No. 96, November, 1903, p. 223, Prof. James Dewar, after describing his method for removing the more condensable constituents of the atmosphere and his process of analyzing the resulting mixture of rare gases, continues as follows:

These experiments prove that air[1] contains as a minimum 1/362,000 of its volume of helium, about 1/70,000 of neon, and not more than 1/100,000 of free hydrogen. * * *

The spectroscopic examination of these gases throws new light upon the question of the aurora and the nature of the upper air. On passing electric discharges through tubes containing the most volatile of the atmospheric gases, they glow with a bright orange light, which is especially marked at the negative pole. The spectroscope shows that this light consists, in the visible part of the spectrum, chiefly of a succession of strong rays in the red, orange, and yellow, attributed to hydrogen, helium, and neon. Besides these a vast number of rays, generally less brilliant, are distributed through the whole length of the visible spectrum. The greater part of these rays are as yet of unknown origin. The violet and ultra-violet part of the spectrum rivals in strength that of the red and yellow rays. As these gases probably include some of the gases that pervade interplanetary space, search was made for the prominent nebular, coronal, and auroral lines.

No definite lines agreeing with the nebular spectrum could be found, but many lines occurred closely coincident with the coronal and auroral spectrum. But before discussing the spectroscopic problem, it will be necessary to consider the nature and condition of the upper air.

According to the old law of Dalton, supported by the modern dynamical theory of gases, each constituent of the atmosphere while acted upon by the force of gravity forms a separate atmosphere, completely independent, except as to temperature, of the others, and the relations between the common temperature and the pressure and altitude for each specific atmosphere can be definitely expressed.

If we assume the altitude and temperature known, then the pressure can be ascertained for the same height in the case of each of the gaseous constituents, and in this way the percentage composition of the atmosphere at that place may be deduced.

Suppose we start with a surface atmosphere having the composition of our air, only containing 2/10,000 of hydrogen; then, at 37 miles, if a sample could be procured for analysis, we believe that it would be found to contain 12 per cent of hydrogen, and only 10 per cent of oxygen. The carbonic acid practically disappears; and by the time we reach 47 miles, where the temperature is minus 132°, assuming a gradient of 3.2° per mile, the nitrogen and oxygen have so thinned out that the only constituent of the upper air which is left is hydrogen. If the gradient of temperature were doubled the elimination of the nitrogen and oxygen would take place by the time 37 miles was reached, with a temperature of minus 220°.

The theoretical distribution of the chief components of our atmosphere, on the assumption of steady equilibrium, is graphically represented in figs. 1 and 2. In these diagrams nitrogen is represented by the horizontal hachure, oxygen by the diagonal hachure, hydrogen by the stippling, argon by the blank white space, and carbonic acid by black. A horizontal line drawn across the diagram at any height marked in kilometers (0.62 mile) shows the percentage by volume of the constituents at that elevation, by the respective lengths within the hachures of the individual constituents. The results of Hinrich's calculations which involve no consideration of the effects of temperature, are represented in fig. 1, and those of Ferrel, who assumes a temperature gradient of 4° per kilometer throughout the upper air, in fig. 2. The higher the assumed temperature gradient the lower the elevation at which the nitrogen and oxygen are eliminated and the true hydrogen atmosphere begins. The elevations marked *A*, *B*, *C*, *D*, in fig. 2, refer to the respective gradients of 4°, 3°, 2°, and 1°, per kilometer, and mark the end of the nitrogen and the beginning of the true hydrogen atmosphere. The position *A* corresponds to 60 kilometers and a temperature of —220°; *B*, to 67 kilometers and —181° C.; *C*, to 76 kilometers and —132°; and *D*, to 87 kilometers and —67°.

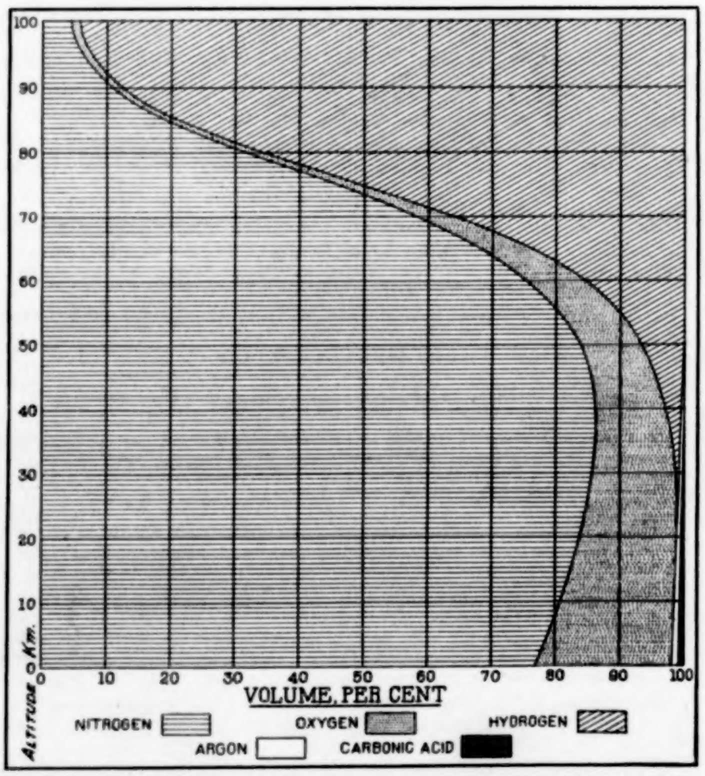



FIG. 1.—Distribution of the atmospheric gases, Hinrich's formula.

[1] We ought rather to say the air of London.—ED.

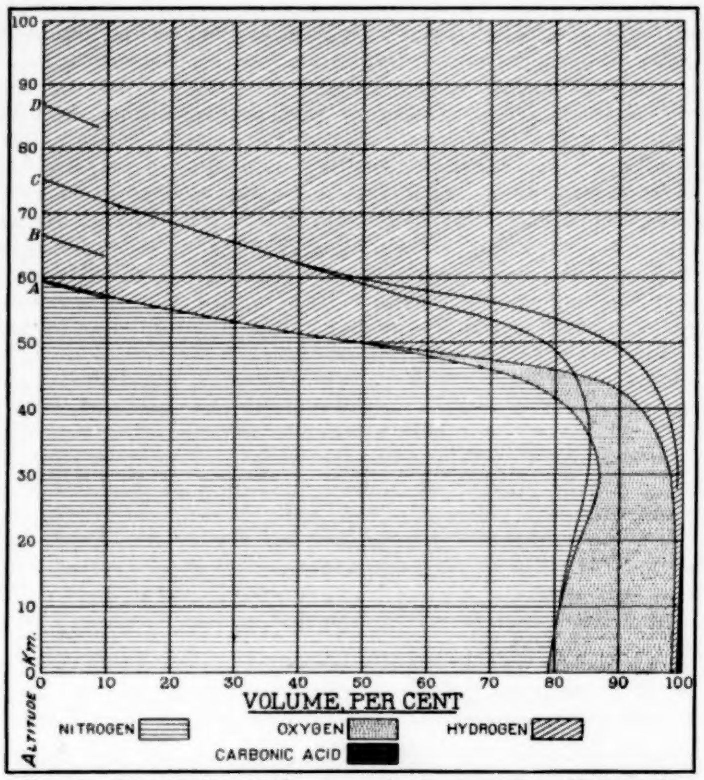


FIG. 2.—Distribution of the atmospheric gases, Ferrel's formula.

On any of these temperature gradient hypotheses it appears that practically above 56 miles the atmosphere would be substantially composed of hydrogen. If helium and neon had been included in the calculations, they would have been found concentrated at high elevation between the regions occupied respectively by the hydrogen and the nitrogen in the diagrams. If the temperature is taken as constant, fig. 2 shows that at an elevation of some 62 miles the composition of a sample of air, if it could be secured, would be 95.1 per cent of hydrogen, 4.6 per cent of nitrogen, and 0.3 per cent of oxygen.

The permanence of the composition of the air at the highest altitudes, as deduced from the basis of the dynamical theory of gases, has been discussed by Stoney, Bryan, and others.[2] It would appear that there is a consensus of opinion that the rate at which gases like hydrogen and helium could escape from the earth's atmosphere would be excessively slow. Considering that to compensate any such loss the same gases are being supplied by actions taking place in the crust of the earth, we may safely regard them as necessarily permanent constituents of the upper air.

The temperature at the elevations we have been discussing would not be sufficient to cause any liquefaction of the nitrogen and oxygen, on account of the pressure being so low. If we assume the mean temperature as about the boiling point of oxygen, then a considerable amount of the carbonic acid must solidify as a mist, if the air from a lower level be cooled to this temperature; and the same result might take place with other gases of relatively small volatility which occur in the air. The temperature of the upper air must be above that on the vapor-pressure curve corresponding to the barometric pressure at the locality, otherwise liquid condensation must take place. In other words, the temperature must be above the dew-point of air at that place. At very high elevations, on any reasonable assumption of temperature distribution, we inevitably reach a temperature where the air would condense, just as Fourier and Poisson supposed it would, unless the temperature is arrested in some way from approaching the zero.

Both ultra-violet absorption and the prevalence of electric storms may have something to do with the maintenance of a higher mean temperature than we should anticipate, following the deductions of our assumed formulas for temperature decrements. The whole mass of the air above 40 miles is not more than 1/700 part of the total mass of the atmosphere, so that any rain or snow of liquid or solid air, if it did occur, would necessarily be of a very tenuous description. In any case, the dense gases tend to accumulate in the lower strata, and the lighter ones to predominate at the higher altitudes, always assuming a steady state of equilibrium has been reached.

It must be observed, however, that a sample of air taken at an elevation of 9 miles has shown no difference in composition from that at the ground, whereas, according to our hypothesis, the oxygen ought to have been diminished to 17 per cent and the carbonic acid should also have become much less. This can only be explained by assuming that a large intermixture of the different layers of the atmosphere is still taking place at this elevation. This is confirmed by a study of the motions of clouds about six miles high, which reveals an average velocity of the air currents of some 70 miles per hour; such violent winds must be the means of causing the intermingling of different atmospheric strata. Some clouds, however, during hot and thundery weather, have been seen to reach an elevation of 17 miles, so that we have direct proof that on occasion the lower layers of atmosphere are carried to a great elevation.

The existence of an atmosphere at more than a hundred miles above the surface of the earth is revealed to us by the phenomenon of twilight and the luminosity of meteors and fireballs. When we can take photographs of meteoric spectra, a great deal may be learned about the composition of the upper air. In the meantime Pickering's solitary spectrum of a meteor reveals an atmosphere of hydrogen and helium, and so far this is a corroboration of the doctrine we have been discussing. It has long been recognized that the aurora is the result of electric discharges within the limits of the earth's atmosphere, but it was difficult to understand why its spectrum should be so entirely different from anything which could be produced artificially by electric discharges through rarefied air at the surface of the earth. Rand Capron, in 1879, after collecting all the recorded observations, was able to enumerate no more than nine auroral rays, of which but one could with any probability be identified with rays emitted by atmospheric air under electric discharge. Vogel attributed this want of agreement between nature and experiment, in a vague way, to difference of temperature and pressure; and Zöllner thought the auroral spectrum to be one of a different order, in the sense in which the line and band spectrum of nitrogen are said to be of different orders.

Such statements were merely confessions of ignorance. But since that time observations of the spectra of auroras have been greatly multiplied, chiefly through the Swedish and Danish polar expeditions. The spectrum recorded on the ultra-violet side has been greatly extended by the use of photography, so that, in a recent discussion of results, M. Henri Stassano is able to enumerate upward of 100 auroral rays, of which the wave length is more or less approximately known. Of this large number of rays he is able to identify, within the probable limits of errors of observation, about two-thirds as rays which Professor Liveing and myself have observed to be emitted by the most volatile gases of atmospheric air unliquefiable at the temperature of liquid hydrogen. Most of the remainder he ascribes to argon, and some might, with more probability, have been identified with krypton or xenon.

The rosy tint often seen in auroras, particularly in the streamers, appears to be due mainly to neon, of which the spectrum is remarkably rich in red and orange rays. One or

[2] See also S. R. Cook in Monthly Weather Review for August, 1902, pp. 401-407, and September, 1902, p. 405.—ED.

two neon rays are amongst those most frequently observed, while the red ray of hydrogen and one red ray of krypton have been noticed only once. The predominance of neon is not surprising, seeing that from its relatively greater proportion in air and its low density it must tend to concentrate at higher elevations.

So large a number of probable identifications warrants the belief that we may yet be able to reproduce in our laboratories the auroral spectrum in its entirety. It is true that we have still to account for the appearance of some and the absence of other rays of the newly discovered gases, which, in the way we stimulate them, appear to be equally brilliant, and for the absence, with one doubtful exception, of all the rays of nitrogen. If we can not give the reason of this it is because we do not know the mechanism of luminescence, nor even when the particles that carry the electricity are themselves luminous, or whether they only produce stresses causing other particles which encounter them to vibrate; yet we are certain that an electric discharge in a highly rarefied mixture of gases lights one element and not another in a way which, to our ignorance, seems capricious.

The Swedish North Polar Expedition concluded from a great number of trigonometrical measurements that the average above the ground of the base of the aurora was 50 kilometers (34 miles) at Cape Thorsden, Spitzbergen;[3] at this height the pressure of the nitrogen of the atmosphere would be only about one-tenth of a millimeter, and Moissan and Deslandres have found that in atmospheric air at pressures less than one millimeter the rays of nitrogen and oxygen fade and are replaced by those of argon and by five new rays which Stassano identifies with rays of the more volatile gases measured by us. Also, Collie and Ramsay's observations on the distance to which electrical discharges of equal potential traverse different gases throw much light on the question. They find that, while for helium and neon this distance is from 250 to 300 millimeters, for argon it is 45½ millimeters, for hydrogen it is 39 millimeters, and for air and oxygen still less.

This indicates that a good deal depends on the very constitution of the gases themselves, and certainly helps us to understand why neon and argon, which exist in the atmosphere in larger proportions than helium, krypton, or xenon, should make their appearance in the spectrum of auroras almost to the exclusion of nitrogen and oxygen.

How much depends not only on the constitution and it may be temperature of the gases, but also on the character of the electric discharge, is evident from the difference between the spectra at the cathode and anode in different gases, notably in nitrogen and argon, and not less remarkably in the more volatile compounds of the atmosphere.

Without stopping to discuss that question, it is certain that changes in the character of the electric discharge produce definite changes in the spectra excited by them. It has long been known that in many spectra the rays which are inconspicuous with an uncondensed electric discharge become very pronounced when a Leyden jar is in the circuit. This used to be ascribed to a higher temperature in this condensed spark, though measurements of that temperature have not borne out the explanation. Schuster and Hemsalech have shown that these changes of spectra are in part due to the oscillatory character of the condenser discharge, which may be enhanced by self-induction, and the corresponding change of spectrum thereby made more pronounced.

If we turn to the question what is the cause of the electric discharges which are generally believed to occasion auroras, but of which little more has hitherto been known than that they are connected with sun spots and solar eruptions, recent studies of electric discharges in high vacua, with which the names of Crookes, Röntgen, Lenard, and J. J. Thomson will always be associated, have opened the way for Arrhenius to suggest a definite and rational answer. He points out that the frequent disturbances which we know to occur in the sun must cause electrical discharges in the sun's atmosphere far exceeding any that occur in that of the earth. These will be attended with an ionisation of the gases, and the negative ions will stream away through the outer atmosphere of the sun into interplanetary space, becoming, as Wilson has shown, nuclei of aggregation of condensable vapors and cosmic dust. The liquid and solid particles thus formed will be of various sizes; the larger will gravitate back to the sun, while those with diameters less than one and a half thousandths of a millimeter, but nevertheless greater than a wave length of light, will in accordance with Clerk-Maxwell's electromagnetic theory, be driven away from the sun by the incidence of the solar rays upon them, with velocities that may become enormous, until they meet other celestial bodies, or increase their dimensions by picking up more cosmic dust, or diminish them by evaporation. The earth will catch its share of such particles on the side that is turned toward the sun, and its upper atmosphere will thereby become negatively electrified until the potential of the charge reaches such a point that a discharge occurs, which will be repeated as more charged particles reach the earth.

[3] This conclusion was afterwards shown to have no logical basis. See Terrestrial Magnetism. 1898. Vol. III, pp. 152-154 and 164-169.—ED.

## TORNADO AT MOUNDVILLE, ALA.

By FRANK P. CHAFFEE, Section Director, Montgomery, Ala., dated February 8, 1904.

The tornado at Moundville, Ala., on January 22, 1904, was first felt 2 miles southwest of Moundville, Hale County, Ala., at about 1:20 a. m., seventy-fifth meridian time. The previous evening was warm, with moderately heavy rains at intervals, and the wind blowing in fitful, heavy gusts from the southeast and south. The tornado was most destructive at Moundville, at which place nearly every building was demolished, several freight cars destroyed, 36 persons killed, and 80 injured out of a population of about 300.

The path of the storm extended from southwest to northeast; it was about 5 miles in length and 200 yards wide at the point of greatest destruction. It was accompanied with a funnel-shaped cloud, which had a phosphorescent glow and emitted blinding flashes of lightning, and from which was heard a loud, rumbling noise, resembling that caused by a number of rapidly-moving freight trains. The tornado lasted but a few minutes, and there seems to have been no evidence of its having any bounding motion.

A large, well-constructed railroad warehouse, 40 other frame buildings, a large water tank, and several freight cars were literally torn to pieces. It is reported that some of the timbers of the structures destroyed were twisted and splintered, and that the ground along the path of the storm was swept bare of vegetation. Bales of cotton, stored in the warehouse mentioned above, were torn open and the cotton scattered for some distance. While the destructive force of the storm did not extend over 5 miles northeast of Moundville, débris from that place is reported to have been carried as far as Tidewater, a village in Tuscaloosa County, about 19 miles to the northeast. Effort was made to ascertain the direction of the whirling motion of the storm, but reports as to this are too conflicting to be of value. The storm occurred at such an hour that few persons saw the funnel-shaped cloud or noted its movements.

At Tuscaloosa, about 15 miles north, and at Greensboro, about 24 miles south of Moundville, there were much lightning, moderately heavy rains, and high, but not destructive, winds.

At Hull, a small town about 5 miles northeast of Moundville, a large lumber mill was destroyed.

At Birmingham, about 60 miles northeast, the wind was also destructive, demolishing 35 cabins in the northern suburbs of that city, though causing no loss of life. The highest regis-

tered wind velocity at that place for 5 minutes was 50 miles per hour from southeast, with an extreme of 60 miles per hour, though the storm seems to have lost its tornado characteristics before reaching that place. The approximate value of property destroyed is as follows: Moundville, $80,000; Hull, $8000; Birmingham, $4000; total, $92,000.

The tornado at Moundville occurred on the southeast side of a decided barometric depression which swept rapidly northeastward over northern Mississippi, or northwestern Alabama, during the night of January 21–22, when the pressure was rather low, though not extremely so, at Birmingham, Meridian, Mobile, and Montgomery.

Fig. 1 shows the section of country through which the storm passed.

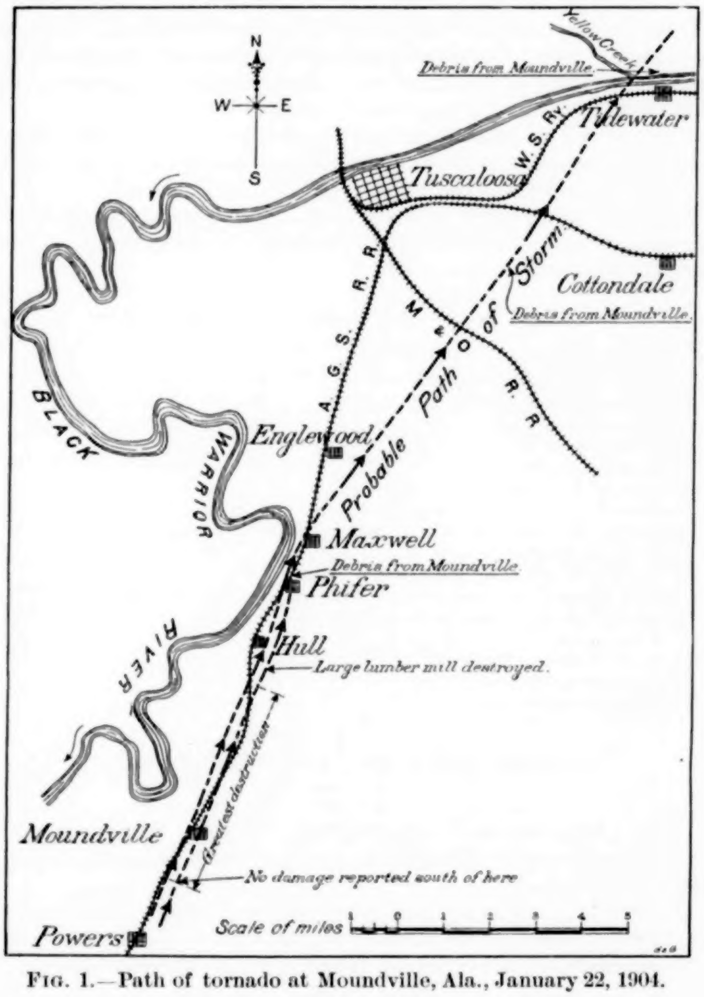



FIG. 1.—Path of tornado at Moundville, Ala., January 22, 1904.

## ARRANGEMENT OF LIGHTNING RODS.[1]

By Prof. W. S. FRANKLIN, Lehigh University, South Bethlehem, Pa., dated February 10, 1904.

1. Good connection of a lightning rod to ground is a prime necessity in lightning rod construction.

2. The experimental and theoretical study of the transmission of rapid electrical oscillations and of abrupt electrical pulses along wires or rods has led to the recognition of the following facts:

(a) Straightness and directness of path to earth is the most important condition in so far as the arrangement of the rod is concerned.

(b) A given weight of metal is much more effective as a carrier of rapid electrical oscillations or abrupt electric pulses when it is in the form of a ribbon or thin-walled tube or wire cable than when it is in the form of a solid rod.

3. If the path along the rod to ground is roundabout, the more direct path through the protected (?) structure is apt to be chosen by the electrical discharge, notwithstanding its poor electrical conductivity and in spite of any ordinary degree of insulation of the rod.

4. The arrangement shown in fig. 1 affords very direct com-

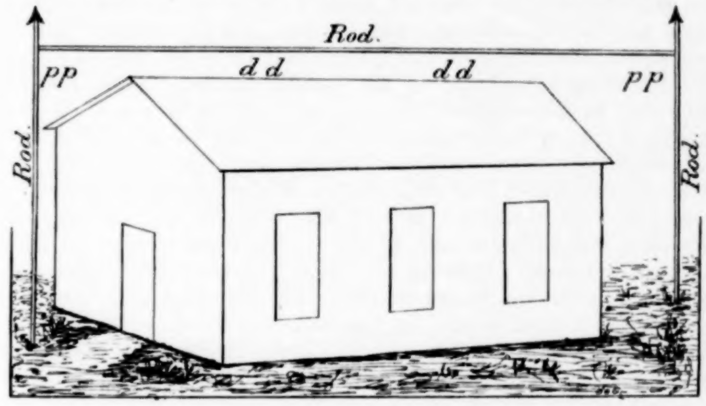



FIG. 1.—A well-protected structure.

munication to ground from the regions *pp pp*, which regions are, therefore, to be considered as well protected. On the other hand, the ground communication from the region *dd* is unnecessarily roundabout, and this region *dd* is, therefore, unnecessarily exposed to danger.

Given a good ground connection, then directness of path to ground from the region which is to be protected is so important that the matter of insulating the rod from the building, either by air spaces or by glass, is of no importance whatever in comparison. If the path is direct, there is no need of insulation; and if the path is roundabout, effective insulation is not practicably feasible.

[1] This article was written, at the request of the Editor, as an answer to a question by a correspondent of The Rural New-Yorker in regard to the arrangement of lightning rods.

## A NEW NEPHOSCOPE.

By LOUIS BESSON.

[Translated from Annuaire de la Société Météorologique de France, February, 1903, p. 29.]

The vertical component of the movement of the clouds introduces into nephoscopic observations an error, the law for which I have recently studied,[1] at least as regards the direction. All along any great vertical circle, in whose plane a cloud moves, the error in direction is zero (or equal to 180°), but it is easy to see that the error in the relative velocity is at its maximum there. I have shown that by making two determinations at the same elevation, perpendicular to the movement of the clouds, the exact direction, and at the same time the inclination can easily be obtained; but this solution is only rigorous if the vertical component has the same value in the whole extent of the sky; moreover, the work of the observer is doubled.

If, neglecting the measurement of the inclination, it is proposed only to determine, under the best possible conditions, the direction and the relative velocity, it is best to observe at the zenith, because there the error in the direction is zero, and the error in the relative velocity is generally negligible. Now, it must be acknowledged that near the zenith the use of the nephoscopic herse[2] is very inconvenient on account of the fatiguing position that the observer must maintain. For such observations the dark nephoscopic room, such as is used at the observatory for dynamic meteorology at Trappes and at the municipal observatory of Montsouris[3] is certainly the most convenient arrangement, but the pictures of the clouds upon

[1] Annuaire de la Société Météorologique de France, 1902, p. 180.
[2] Annales de l'Observatoire Municipal de France, 1901, p. 50.
[3] Annales de l'Observatoire Municipal de France, 1901, p. 17.

the screen are necessarily much less bright than the clouds themselves, and when these latter are pale or nearly uniform, or again when the daylight is feeble, the images in the dark room have not the clearness necessary for making good observations.

The preceding considerations have led me to construct a new nephoscope, which will render observations in the neighborhood of the zenith easy, and obviate the inconveniences of the dark room. It consists essentially of a horizontal frame upon which are stretched two orthogonal systems of parallel and equi-distant threads, forming a lattice. By standing above this frame and looking at the clouds through it, their direction may be determined by turning the frame in such a manner that one of the systems of threads will be parallel with it; the other system of threads is then perpendicular to the motion of the clouds and enables us to determine their relative velocity. As a matter of fact the observation is not made directly, but with the aid of an inclined plane mirror placed below the frame. This arrangement has a twofold advantage; first it relieves the observer from an uncomfortable position; and in the second place, for the same elevation of frame, it increases the useful length of the instrument by the distance which separates the eye from the mirror. The position of the eye is fixed by means of an eye hole which may be furnished with a piece of smoked glass, if it is thought necessary.

In the model constructed according to our instructions by Richard, the frame is circular and has a diameter of 0.65 meter; it is supported by three rods resting upon an annular metallic plate. This is the movable part of the instrument. The fixed base is formed of a wooden disk, the upper side of which is divided into degrees; this disk is set and fixed immovably upon a pillar or some kind of a pedestal. The support of the mirror, fixed to this wooden disk, fits the central part of the annular metallic plate and serves it as an axis of rotation. Upon the edge of this bevelled plate are engraved four reference lines, traced parallel to the threads of the frame. The direction is read upon the graduated scale of the disk, opposite to the reference mark on the side from whence the clouds come. The height of the instrument above its socket is 1.10 meters, but on account of the reflection from the mirror it seems as though the eye was exactly 1.50 meters below the frame. The space from one thread to the other, upon this frame, is 0.075 meter or 1/20 the distance from the eye. Consequently, the relation of the height of the clouds, $H$, to their velocity $V$ is given, as in the dark nephoscopic room, by the formula:

$$\frac{H}{V} = 20\frac{t}{n},$$

$n$ being the number of spaces passed over by the observed point and $t$ the time occupied in passing over. Two nephoscopes of this pattern have been in use for more than six months at stations of the municipal meteorological service, where they are used specially in the study of the influence of Paris upon the movement of the upper currents. For researches of this kind, it was indispensable that the observations at each station should be made in close proximity to the zenith; and it was, therefore, advisable to put into the hands of the observers an instrument the field of which was limited to this part of the sky. In ordinary meteorological observations it will be advantageous to make use of this nephoscope whenever the layer of clouds whose motion it is intended to determine is situated in the neighborhood of the zenith.

## THE EARTHQUAKE OF JANUARY 20, 1904, AT WASHINGTON, D. C.

By Prof. C. F. MARVIN.

The fourth great earthquake of very distant origin to be recorded at the Weather Bureau occurred on January 20, 1904, at $9^h\ 58^m\ 38^s$ a. m., seventy-fifth meridian time. While the disturbance at Washington was wholly imperceptible to ordinary sensations, yet the horizontal movement of the ground was greater than in any of the earthquakes thus far recorded.

The apparatus by which this earthquake was recorded has already been described in the MONTHLY WEATHER REVIEW for June, 1903, page 271.

It is interesting to note, in connection with this earthquake, that for fully twenty-four hours preceding the disturbance the seismograph record showed minute waves of earth movement extending more or less continuously throughout the whole time. It is also to be remarked in this connection that a vast area of high barometer dominated the whole eastern area of the United States from January 18 to 20.

It is not to be inferred that the writer argues that there is any necessary connection between the earthquake and the high barometer. This is hardly probable, although the high barometer may in some way have contributed to produce the minute pulsations referred to.

The waves of displacement, as shown by the record, are unusually regular and of a simple sinusoidal type. The period is also, on the whole, relatively long.

The following table gives the times of the pricipal features of the disturbance. The north and south component of horizontal motion only is recorded:

*January 20, 1904, a. m., seventy-fifth meridian time.*

| | h. | m. | s. | h. | m. | s. |
|---|---|---|---|---|---|---|
| First preliminary tremors | 9 | 58 | 38 a. m. | | | |
| Second preliminary tremors | 10 | 3 | 52 a. m. | | | |
| Principal portion began | 10 | 8 | 50 a. m. | | | |
| Principal portion ended | 10 | 11 | 50 a. m. | | | |
| Maximum waves at | 10 | 11 | 16 a. m. | | | |
| End of earthquake | 10 | 51 | 51 a. m. | | | |
| Duration of first preliminary tremor | | | | 0 | 5 | 14 |
| Duration of second preliminary tremor | | | | 0 | 4 | 58 |
| Average period of waves in principal portion (seven complete waves in $2^m\ 45^s$) | | | | | | 23.6 |
| Period of slow waves of principal portion | | | | | | 25.8 |
| Period of shorter and maximum waves of principal portion | | | | | | 19.0 |
| Period of uniform waves in final portion | | | | | | 17.3 |
| Period of pendulum | | | | | | 26.0 |
| Maximum double amplitude of actual displacement of earth at seismograph | | | | 0.4 mm. | | |
| Magnification of record | | | | 10 | | |

## LUNAR HALO OF JANUARY 30, 1904.

By Rev. F. L. ODENBACH, S. J.

A halo was observed on January 30, 1904, at Ignatius College Observatory, Cleveland, Ohio, 7:20 p. m., seventy-fifth meridian time.

The sky at the time was evenly covered with a thin pallium of stratus; stars of the first magnitude were visible through it.

I observed four of the so-called Newton's rings around the moon.

I Ring.—Blue, white, yellow, red, 2°.

II Ring.—Blue, green, yellow, red, 6°.

III Ring.—Blue, green, red, 10°.

IV Ring.—Red, 12° to 15°.

It was very brilliant, in fact the most perfect and elaborate I have ever seen. The measurements were taken with a theodolite, the tube of which is plain and without lenses, made for this kind of work. The angles were read in a hurry and to the nearest degree, since I followed the same method as in the observations of the Hevelian halo of 90° in 1901, and with the same luck, as the phenomenon lasted only for about five to eight minutes.

After that the pallium thickened and finally broke into denser cloud, strato-cumulus, the altitude of which I measured and found to be 4783 feet (method described in 8th Annual Report of the Ignatius College Observatory, 1902–03).

The most prominent part of the corona was the yellow and

red of the first series of colors. The red of the fourth ring was faint and seemed to be fringed with white.

The time of observation was so short that I can give nothing more in the way of facts. But from the general impression received I think that if time had allowed I could have made out not only the primary colors but also the mixture as given by Newton for his 1, 2, 3, 4 orders. The three first of these he actually observed in June, 1692, and calculated the rest.

## STUDIES ON THE CIRCULATION OF THE ATMOSPHERES OF THE SUN AND OF THE EARTH.

By Prof. FRANK H. BIGELOW.

### III.—THE PROBLEM OF THE GENERAL CIRCULATION OF THE ATMOSPHERE OF THE EARTH.

#### THE CANAL THEORY.

In my Cloud Report, Annual Report of the Chief of the Weather Bureau, 1898–1899, Volume II, chapter 11, it was shown that for the United States the canal theory of the general circulation of the atmosphere, as worked out by Ferrel and by Oberbeck, does not sufficiently conform to the observations on cloud motions to be a satisfactory solution of the problem. The Report of the International Committee, 1903, by H. H. Hildebrandsson, reached the same conclusions for nearly all parts of the Northern Hemisphere, and, therefore, that canal theory may be finally abandoned. The following paper contains some suggestions on this subject which seem promising, and adapted to laying the foundation for a new development of this branch of theoretical meteorology. The physical facts to be accounted for may be found in the two publications referred to, also in my Papers on the Statics and Kinematics of the Atmosphere in the United States,[22] and they need not be recapitulated in this place.

#### THE GENERAL EQUATIONS OF MOTION.

Referring to the well-known general equations of motion as summarized in the Weather Bureau Cloud Report, from equation (155) we have

$$(1)\qquad \begin{aligned} -\frac{1}{\rho}\frac{\partial P}{\partial x}-\frac{\partial V}{\partial x}&=\frac{du_1}{dt}.\\ -\frac{1}{\rho}\frac{\partial P}{\partial y}-\frac{\partial V}{\partial y}&=\frac{dv_1}{dt}.\\ -\frac{1}{\rho}\frac{\partial P}{\partial z}-\frac{\partial V}{\partial z}&=\frac{dw_1}{dt}.\end{aligned}$$

These are transformed into the first form of polar equations (181), these again into the forms (200) and (201) in succession, so that the common integral becomes

$$(2)\qquad \int-\frac{dP}{\rho}=\int\left(\frac{du}{dt}\partial x+\frac{dv}{dt}\partial y+\frac{dw}{dt}\partial z\right)+V-C.$$

The usual method of development proceeds by taking

$$(3)\qquad u=\frac{\partial x}{\partial t},\quad v=\frac{\partial y}{\partial t},\quad w=\frac{\partial z}{\partial t},\qquad \text{so that}$$

$$(4)\qquad \begin{aligned}\int-\frac{dP}{\rho}&=\int(udu+vdv+wdw)+V-C\\ &=\tfrac{1}{2}(u^2+v^2+w^2)+V-C\\ &=\tfrac{1}{2}q^2+V-C.\end{aligned}$$

This is the ordinary form of the equation of motion on the rotating earth as given in treatises on hydrodynamics, as in Lamb, p. 22, and Basset, Vol. I, p. 34, and is known as Bernoulli's Theorem. $C$ is not an absolute constant, but is the function of the parameter of a stream line; and in the atmosphere, where the flow takes place in stratified layers having different temperatures and angular momenta, it changes from one stratum to another.

It is also possible to integrate these terms along an arbitrary line, $s=\int ds=\int(dx, dy, dz)$, and in this case the derivative relative to the velocity will give acceleration along $ds$; that is, we have $\dot{q}ds$ instead of $qdq$, and under some circumstances this may prove to be an advantageous method. In meteorology this will depend, however, upon whether the one or the other set of terms that are required are most practically observed, as line integrals may be readily computed for either of these systems.

[22] Monthly Weather Review, Vol. XXX, pp. 13, 80, 117, 163, 250, 304, 347.

#### LINE INTEGRALS IN THE ATMOSPHERE.

The principles of the canal theory of circulation have been applied by V. Bjerknes[23] and J. W. Sandström[24] in their papers on circulation, under the form of line integrals around arbitrary closed curves in the atmosphere. Thus, the circulation is expressed by them, with the vertical and horizontal components of the total enclosed curve, as

$$\begin{array}{llll} & \text{Total circulation.} & \text{Relative component.} & \text{Earth's component.}\\ (5) & C_a & =\ C & +\ C_e\\ (6) & \int q_a ds & =\int q\,ds & +\ 2\,\omega_0 S_1\\ (7) & \int\frac{dq_a}{dt}ds & =\int\frac{dq}{dt}ds & +\ 2\,\omega_0\frac{dS_1}{dt}\\ (8) & -\int\frac{dP}{\rho\,.\,ds}\cdot ds & =\int\dot{q}\,ds & +\ \frac{d}{dt}\cdot 2\,\omega_0\int\tfrac{1}{2}\varpi\cos i\cos\theta\,ds+R\\ (9) & -\int\frac{dP}{\rho} & =\int\dot{q}\,ds & +\ 2\,\omega_0\cos\theta\,.\,\frac{dS}{dt}+R \end{array}$$

Equation (7) is the time rate of change.

$C_a$ = the line integral of the tangential component of total velocity.

$C$ = the line integral of the relative velocity (tangential.)

$C_e$ = the line integral of the velocity of a point on the moving earth itself (tangential).

$(q_a, q, q_e)$ = the velocities; $(\dot{q}_a, \dot{q}, \dot{q}_e)$ = the accelerations.

$R$ = friction; $\omega_0$ = the angular velocity of the earth.

$P$ = pressure; $\rho$ = density.

$i$ = the angle on the plane of the parallel of latitude that $ds$ makes with the direction of a moving point of the earth.

$S_1$ = the projection of the closed curve $S$ on the plane of the equator for the polar distance $\theta$.

These integrations involve an accurate knowledge of the pressure, density, and acceleration at numerous points along the chosen closed curve, and this it is very difficult to obtain by practicable observations. The variation of $S$ can be found more readily. Several illustrations are given by the authors in applying the theory to the general circulation of the atmosphere and to the local cyclones and anticyclones, but these illustrations do not seem to conform satisfactorily to the conditions observed in North America, as will be set forth in the other papers of this series and in a full report on the subject.

There arises no question with respect to any of the terms of the equation except the one containing $\frac{dS_1}{dt}$, which appears to be an addition to the usual form of the equation of motion on the rotating earth. As has been shown by V. Bjerknes, if the angle $\theta$ can be taken constant for a given relatively small closed curve, we have

$$(10)\qquad 2\,\omega_0\frac{dS_1}{dt}=2\,\omega_0\cos\theta\frac{d}{dt.}\int\tfrac{1}{2}\varpi\cos i\,ds,$$

where $i$ is the angle that the element $ds$ makes with the parallel of latitude, or the angle between the two radii of an ele-

[23] Meteorol. Zeitschrift, March, 1900; April, 1900; November, 1900; March, 1902.

[24] Kon. Svens. Vet.—*Ak.* Handlingar, *Bd.* 83, No. 4; Meteorol. Zeitschrift, April, 1902; Vetens. *Ak.* 1902, No. 3.

mentary area, as shown in fig. 14. Hence, for a line integral we have,

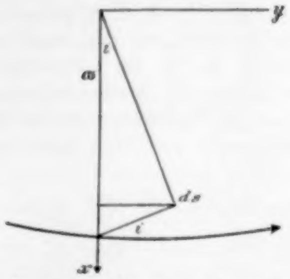



FIG. 14.—Component axes.

$$(11)\quad \frac{d}{dt}\int \tfrac{1}{2}\,\varpi \cos i.\, ds = \tfrac{1}{2}\int \frac{d\,\varpi}{dt}.\cos i\, ds - \tfrac{1}{2}\int \varpi\,\frac{di}{dt}.\sin i\, ds$$

$$= \tfrac{1}{2}\Big(u\, dy - v\, dx\Big),$$

$$\text{since}\ \frac{d\varpi}{dt} = u, \quad \varpi\frac{di}{dt} = v, \quad ds\cos i = dy, \quad ds\sin i = dx.$$

We have in the case of a velocity potential, $u\,dy - v\,dx = 0$; and, as is well known, the only influence of the rotation of the earth is to add a deflecting force always at right angles to the direction of motion. The integral of the work done in moving a particle, $\int\frac{dq}{dt}.\,ds$, receives no additional term from the fact that the earth rotates, any more than a planet alters the velocity in its orbit from a force perpendicular to its path. We thus obtain $2\,\omega_0\,\frac{dS_1}{dt} = 0$, and all the developments derived from its use must be carefully interpreted. It seems important to have made this fact clear, in order that the equation used as the basis of the following analysis may be taken without modifications. If the gravity potential $V = gz$ is added we obtain the complete equation. The line integral of a gravity force around a closed curve is, also, always zero.

EQUIVALENT EXPRESSIONS FOR THE DENSITY $\rho$.

The specific volume or isoster, $\frac{1}{\rho} = v$, in the term $\frac{P}{\rho}$, can be discussed in four different ways, and substitutes for it can be introduced into the equation.

1. From Bigelow's equation (47*a*), Cloud Report, we have

$$(12)\quad \frac{1}{\rho} = \frac{1}{\rho_0}\cdot\frac{P_0}{P}\,\frac{T}{T_0} = \frac{1}{\rho_0}\cdot\frac{P_0}{P}\,(1 + a\,t),$$

where the variations are expressed in terms of $\rho_0$, $P_0$, $P$ and the thermometric temperature $t$. This is the common procedure among meteorologists.

2. From equation (75), the Boyle-Gay Lussac law of gases,

$$(13)\quad \frac{1}{\rho} = \frac{R\,T}{p} = v,$$

where the variations are given in terms of $R$, $T$, $p$—the gas constant, the absolute temperature, and the weight—and this has been used in some discussions. Since the atmosphere is not arranged upon the adiabatic law, but diverges from it considerably, this method must be cautiously introduced, though there is a strong temptation to use the absolute temperature on account of its convenience.

3. Since we have $\frac{1}{\rho} = \left(\frac{p_0}{p}\right)^{\frac{1}{k}}\frac{1}{\rho_0}$, by equation (84), and $\frac{1}{\rho_0} = \frac{R\,T_0}{p_0}$, by (75), we obtain the third form,

$$(14)\quad \frac{1}{\rho} = \left(\frac{p_0}{p}\right)^{\frac{1}{k}}\frac{R\,T_0}{p_0},$$

$$(15)\quad \frac{1}{\rho} = p_0^{\frac{1-k}{k}}\,R\,T_0\,p^{-\frac{1}{k}},$$

where $R$ is the gas constant, and $T_0 = \theta_0$ the potential temperature. This form was employed by H. von Helmholtz, and it has several advantages over the others in applications to the atmosphere.

4. By reducing the volume $\frac{1}{\rho}$ to unit density so that $\rho_0 = 1$, we shall find that

$$(16)\quad \frac{1}{\rho} = \frac{k}{k-1}\,R^{\frac{1}{k}}\,\theta^{\frac{1}{k}}\,\frac{k-1}{k}\,p^{-\frac{1}{k}},$$

which is the form used by Emden in his paper on the solar circulation.

5. The potential temperature is found practically from the formula

$$(17)\quad \theta = \theta_0\left(\frac{p}{p_0}\right)^{\frac{k-1}{k}} = \theta_0\left(\frac{B}{B_0}\right)^{0.2889},$$

or in logarithms,

$$(18)\quad \log\theta = \log\theta_0 + 0.2889\,(\log B - \log B_0).$$

DEVELOPMENT OF THE TERMS $\frac{\omega}{\rho}$, $V$, AND $\frac{dr}{d\varpi}$.

Since the pressure $P$ in units of force $= g_0 p$, we have from (15)

$$(19)\quad \frac{P}{\rho} = g_0 p_0^{\frac{1-k}{k}}\,R.\theta.\,p^{-\frac{1}{k}}\,p = g_0 p_0^{\frac{1-k}{k}}\,R.\theta.\,p^{\frac{k-1}{k}}.$$

$$\left.\begin{aligned} &(20)\quad \frac{P}{\rho} = A.\theta.\pi \\ &(21)\quad \frac{\partial P}{\rho\partial\varpi} = A.\theta.\frac{\partial\pi}{\partial\varpi} \\ &(22)\quad \frac{\partial P}{\rho\partial r} = A.\theta.\frac{\partial\pi}{\partial r} \end{aligned}\right\}\ \text{for}\ \left\{\begin{aligned} &A = g_0 p_0^{\frac{1-k}{k}}\,R. = \text{constant.} \\ &\theta = \theta_0\left(\frac{p}{p_0}\right)^{\frac{1-k}{k}}. \\ &\pi = p^{\frac{k-1}{k}} = p^{0.2889}. \end{aligned}\right.$$

The gravity potential, including the centrifugal force of rotation about the axis $z$, with the angular velocity $\omega_0$, at the distance $\varpi$ is, for the positive direction of $r$ outwards,

$$(23)\quad -V = +gr - \tfrac{1}{2}\,\omega_0^2\,\varpi^2.$$

$$(24)\quad -V = \frac{g_0 R^2}{r} - \tfrac{1}{2}\,v_0^2.$$

Hence the original equation (4) is transformed as follows:

$$(25)\quad \frac{P}{\rho} = -\tfrac{1}{2}\,(u^2 + v^2 + w^2) - V + C.$$

$$(26)\quad A\theta\pi = -\tfrac{1}{2}\,(u^2 + v^2 + w^2) - \tfrac{1}{2}\,v_0^2 + \frac{g_0 R^2}{r} + C.$$

$$(27)\quad A\theta\pi = -\tfrac{1}{2}\,(v^2 + v_0^2) - \tfrac{1}{2}\,(u^2 + w^2) + \frac{g_0 R^2}{r} + C.$$

The equations of motion for two strata flowing over each other, and having different potential temperatures and angular momenta, become,

(28) First stratum:

$$\frac{1}{\theta_1}\frac{g_0 R^2}{r} = A\pi_1 + \tfrac{1}{2}\,(v_1^2 + v_0^2)\,\frac{1}{\theta_1} - \frac{C_1}{\theta_1} + \tfrac{1}{2}\,(u^2 + w^2)_1\,\frac{1}{\theta_1}.$$

(29) Second stratum:

$$\frac{1}{\theta^2}\frac{g_0 R^2}{r} = A\pi_2 + \tfrac{1}{2}\,(v_2^2 + v_0^2)\,\frac{1}{\theta_2} - \frac{C_2}{\theta_2} + \tfrac{1}{2}\,(u^2 + w^2)_2\,\frac{1}{\theta_2}.$$

At the discontinuous surface of flow the pressure $\pi_1 = \pi_2$, hence,

$$(30)\quad \left(\frac{1}{\theta_1} - \frac{1}{\theta_2}\right)\frac{g_0 R^2}{r} = \tfrac{1}{2}\,\frac{(v_1^2 + v_0^2)}{\theta_1} - \tfrac{1}{2}\,\frac{(v_2^2 + v_0^2)}{\theta_2} - \frac{C_1}{\theta_1} + \frac{C_2}{\theta_2} + \tfrac{1}{2}\,\frac{(u^2 + w^2)_1}{\theta_1} - \tfrac{1}{2}\,\frac{(u^2 + w^2)_2}{\theta_2}.$$

The terms in $u$ and $w$ may not always be neglected where there are strong meridional and vertical currents, as in cyclones and anticyclones.

TO FIND THE DIRECTION OF THE BOUNDARY CURVE BETWEEN TWO STRATA.

1. Differentiate (27) for $r$ with $\varpi$ constant.

$$(31)\qquad A\theta d\pi = -\frac{g_0 R^2 dr}{r^2} = -g dr.$$

Then, in crossing the boundary from the first to the second stratum,

$$(32)\qquad A\frac{d(\pi_1-\pi_2)}{dr} = -g\left(\frac{1}{\theta_1}-\frac{1}{\theta_2}\right) = -g\left[\frac{\theta_2-\theta_1}{\theta_1\theta_2}\right].$$

2. Differentiate for $\varpi$ with $r$ constant, at the same time holding the angular momentum ($v\varpi$) constant in each stratum. Equation (27) can be written:

$$(33)\qquad g_0\frac{R^2}{r} = A\theta\pi + \tfrac{1}{2}\frac{(v^2\varpi^2)}{\varpi^2} + \tfrac{1}{2}\omega_0^2\varpi^2 + \tfrac{1}{2}(u^2+w^2) - C.$$

Differentiating,

$$(34)\qquad 0 = A\theta d\pi - \tfrac{1}{2}\cdot\frac{2\varpi(v^2\varpi^2)d\varpi}{\varpi^4} + \tfrac{1}{2}\cdot 2\omega_0^2\varpi d\varpi + u\frac{du}{d\varpi} + \frac{wdw}{d\varpi}.$$

$$(35)\qquad A\theta d\pi = +v^2\frac{d\varpi}{\varpi} - v_0^2\frac{d\varpi}{\varpi} - \left(\frac{udu}{d\varpi}+\frac{wdw}{d\varpi}\right).$$

For the two strata,

$$(36)\qquad A\frac{d(\pi_1-\pi_2)}{d\varpi} = \frac{1}{\varpi}\left(\frac{v_1^2-v_0^2}{\theta_1}-\frac{v_2^2-v_0^2}{\theta_2}\right)$$

$$-\frac{1}{d\varpi}\left[\left(\frac{udu}{d\varpi}+\frac{wdw}{d\varpi}\right)_1\frac{1}{\theta_1}-\left(\frac{udu}{d\varpi}+\frac{wdw}{d\varpi}\right)_2\frac{1}{\theta_2}\right]$$

$$=\frac{1}{\varpi}\left[\frac{(v_1^2-v_0^2)\theta_2-(v_2^2-v_0^2)\theta_1}{\theta_1\theta_2}\right],$$

omitting terms of the second order.

3. Finally, dividing (36) by (32), we obtain,

$$(37)\qquad \frac{dr}{d\varpi} = -\frac{1}{g\varpi}\left[\frac{(v_1^2-v_0^2)\theta_2-(v_2^2-v_0^2)\theta_1}{\theta_2-\theta_1}\right].$$

This equation defines the slope of the curve which separates the two stratified currents that flow past each other, preserving their angular momenta, $\Omega = v\varpi = \omega\varpi^2 = constant$, according to the vortex law, where $\omega$ is the total angular velocity upon the rotating earth and $\varpi$ is the distance from the axis of rotation. It can be written and interpreted in three different ways, and this gives rise to three cases, each of which finds its application in atmospheric circulations. The equations given in the papers by von Helmholtz and by Emden can be readily transposed into Case I and Case III, but Case II has not been considered heretofore. Omitting terms in $u$ and $w$, these three cases may be expressed as in equations (38), (39), and (40), following.

CASE I. APPLICABLE TO THE TEMPERATE AND POLAR LATITUDES OF THE EARTH.

$$\theta_1 > \theta_2 \text{ and } \frac{v_1^2-v_0^2}{\theta_1} > \frac{v_2^2-v_0^2}{\theta_2} \text{ for } \begin{bmatrix} v_1 > v_0 \\ v_2 > v_0 \\ v_1 > v_2 \end{bmatrix} \begin{matrix}\text{eastward}\\ \text{relative}\\ \text{velocities.}\end{matrix}$$

$$(38)\qquad \frac{+dr}{-d\varpi} = -\left[\frac{(v_2^2-v_0^2)\theta_1-(v_1^2-v_0^2)\theta_2}{\theta_1-\theta_2}\right] = -\left[\frac{-}{+}\right].$$

The second member of the equation is positive if

$$\frac{v_1^2-v_0^2}{\theta_1} > \frac{v_2^2-v_0^2}{\theta_2},$$

where $v_1 > v_0$, $v_2 > v_0$, $v_1 > v_2$, and $\theta_1 > \theta_2$, that is to say, if the higher strata have a higher potential temperature and greater eastward relative velocity than the lower, the quantities being arranged as in fig. 15.



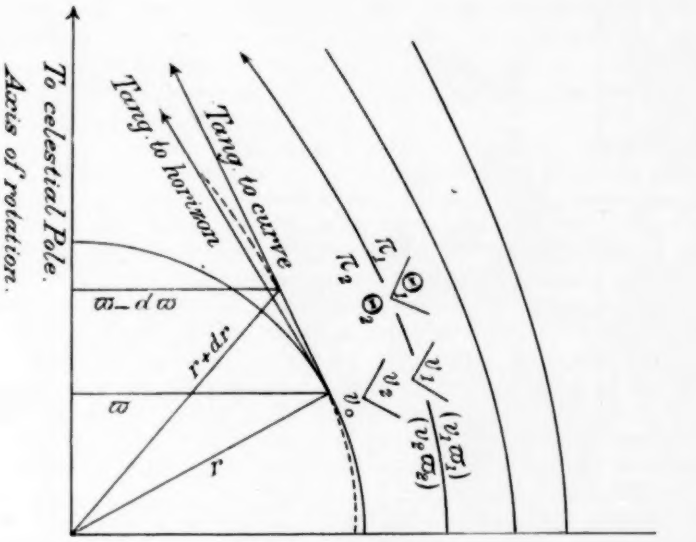



FIG. 15.—Case I.

Take a point in the atmosphere defined by ($r$, $\varpi$) the radius and the radius of rotation, respectively. The next successive point on the line of separation of the two gyrating strata is given by ($r + dr$), ($\varpi - d\varpi$) as indicated, so that the curve continually rises above the successive tangents to the horizon, but approaches the axis of rotation in the direction of the celestial pole. Since ($v_1^2 - v_0^2$) is the square of the relative linear eastward velocity, it follows that the strata in the atmosphere subject to this law have a continually greater eastward drift and greater potential temperatures with the increase in altitude above the surface. These conditions are characteristic of the earth's atmosphere beyond a certain latitude which varies with the height above the surface. The Weather Bureau Cloud Report, 1898, proved that the velocities and also the potential temperatures for the United States conform to Case I, as in chapters 12, 13, and 14, which contain a discussion of the departure of the temperatures of the upper strata from the adiabatic law in the sense that these strata are overheated. Those velocities have been properly prepared for immediate introduction into the above formula.

CASE II. APPLICABLE TO THE TROPICAL ZONES OF THE EARTH.

$$\theta_1 < \theta_2 \text{ and } \frac{v_1^2-v_0^2}{\theta_1} < \frac{v_2^2-v_0^2}{\theta_2} \text{ for } \begin{bmatrix} v_1 < v_0 \\ v_2 < v_0 \\ v_1 > v_2 \end{bmatrix} \begin{matrix}\text{westward}\\ \text{relative}\\ \text{velocities.}\end{matrix}$$

$$(39)\qquad \frac{-dr}{-d\varpi} = -\frac{1}{g\varpi}\left[\frac{(v_2^2-v_0^2)\theta_1-(v_1^2-v_0^2)\theta_2}{\theta_1-\theta_2}\right] = -\left[\frac{-}{-}\right]$$

The second member of the equation is negative if

$\frac{v_2^2-v_0^2}{\theta_2} > \frac{v_1^2-v_0^2}{\theta_1}$, where $v_1 < v_0$, $v_2 < v_0$, $v_1 > v_2$, and $\theta_1 < \theta_2$, that is to say, if the higher strata have lower potential temperatures than the lower, and the lower strata a greater westward relative velocity than the higher, the quantities being arranged as in fig. 16.

Take a point in the atmosphere defined by ($r$, $\varpi$) and the next successive point on the line of separation is given by ($r-dr$), ($\varpi-d\varpi$), as indicated, so that the curve continually falls below the successive tangents to the horizon, and approaches the axis of rotation in the direction of the celestial pole. The relative velocity is westward, since $v_0$ is greater than $v_1$ and $v_2$, so that $v_1^2-v_0^2$ and $v_2^2-v_0^2$ are both negative quantities. Since $v_1^2-v_0^2$ is a smaller negative quantity than $v_2^2-v_0^2$, the numerator is negative. Also, the denominator is negative, for $\theta_1 < \theta_2$. These conditions are fulfilled in the tropical zones where the westward drift is greater in the lower strata and diminishes upward, while the potential tempera-

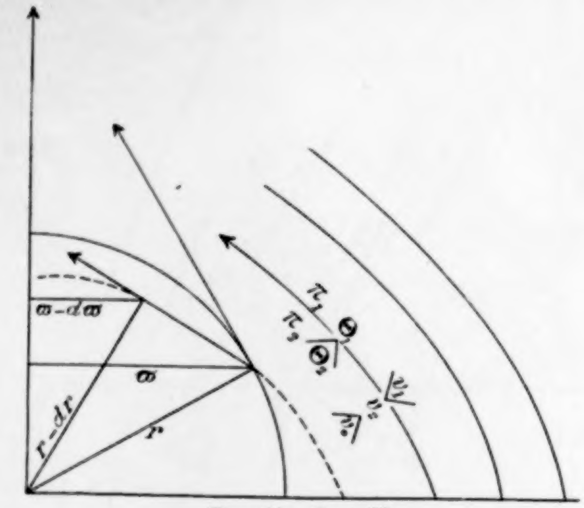



FIG. 16.—Case II.

tures decrease upward. Chapter 8 of the full report will discuss the velocities in the tropical zones of the West Indies. The potential temperatures in the Tropics still remain to be computed.

CASE III. APPLICABLE TO THE ATMOSPHERES OF THE SUN, JUPITER, AND SATURN.

$$\theta_1 > \theta_2 \text{ and } \frac{v_1^2 - v_0^2}{\theta_1} < \frac{v_2^2 - v_0^2}{\theta_2} \text{ for } \begin{bmatrix} v_1 > v_0 \\ v_2 > v_0 \\ v_1 < v_2 \end{bmatrix} \begin{matrix}\text{eastward} \\ \text{relative} \\ \text{velocities.}\end{matrix}$$

$$(40)\quad \frac{+dr}{+d\varpi} = -\frac{1}{g\varpi}\left[\frac{(v_2^2 - v_0^2)\,\theta_1 - (v_1^2 - v_0^2)\,\theta_2}{\theta_1 - \theta_2}\right] = -\left[\frac{+}{+}\right]$$

The second member of the equation is negative if

$\frac{v_2^2 - v_0^2}{\theta_2} > \frac{v_1^2 - v_0^2}{\theta_1}$, where $v_1 > v_0$, $v_2 > v_0$, $v_1 < v_2$, and $\theta_1 > \theta_2$, that is to say, if the higher strata have a higher potential temperature and a smaller eastward relative velocity than the lower, the quantities being arranged as in fig. 17.

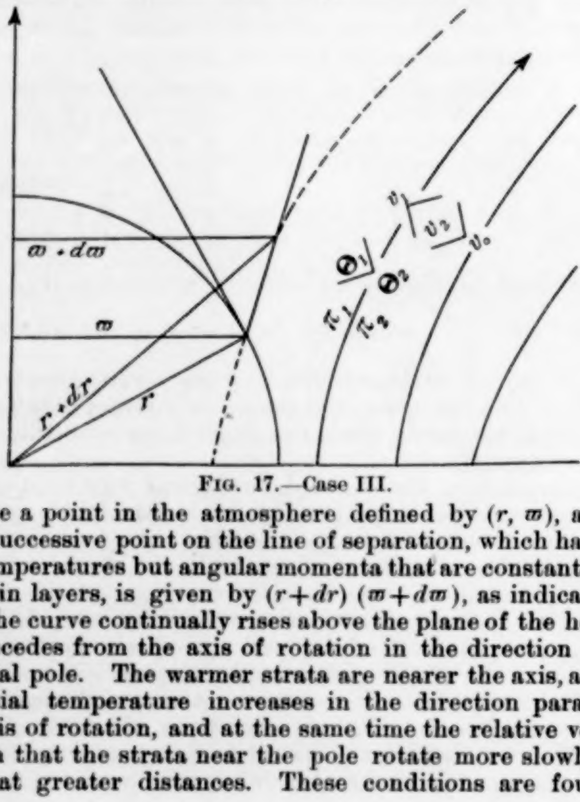



FIG. 17.—Case III.

Take a point in the atmosphere defined by $(r, \varpi)$, and the next successive point on the line of separation, which has varying temperatures but angular momenta that are constant within the thin layers, is given by $(r+dr)\ (\varpi+d\varpi)$, as indicated, so that the curve continually rises above the plane of the horizon, and recedes from the axis of rotation in the direction of the celestial pole. The warmer strata are nearer the axis, and the potential temperature increases in the direction parallel to the axis of rotation, and at the same time the relative velocity is such that the strata near the pole rotate more slowly than those at greater distances. These conditions are found to prevail in the atmospheres of the sun, also of the planets Jupiter and Saturn, as attested by the belt formations and the systems of vortices penetrating to the surface. On the sun the granules of the photosphere are the ends of vortex tubes between adjacent strata having different velocities. Similar vortex tubes are seen on the two planets.

THE INTERACTION OF CASE I AND CASE II IN THE EARTH'S ATMOSPHERE IN THE FORMATION OF LOCAL CYCLONES AND ANTICYCLONES.

In the earth's atmosphere the boundary between the eastward drift of the temperate zones and the westward drift of the tropical zones is an arch spanning the equator high up into the cirrus cloud strata, and resting on the surface at latitudes 30° to 25°. On the poleward side Case I applies but on the side toward the equator Case II prevails.

If the circulations of Case I in the temperate and polar zones, and of Case II in the tropical zones, are applied without further conditions, the isobars in the atmosphere will be distributed, as in fig. 18, so that they rise from the arched boundary of the eastward and the westward relative velocities toward the pole and toward the plane of the equator respectively. This, however, is not the course of the surfaces of pressure in the atmosphere as determined by the observations near sea level, and by computations at higher levels. To illustrate the actual conditions, in fig. 20 Ferrel's values of the isobars on the sea level are given from pole to pole, and Sprung's isobars for the 2000-meter and the 4000-meter planes. The practical problem is, therefore, to account satisfactorily for the modifications of the types. In the present state of meteorology we enter upon a field that is incompletely explored, so that the following remarks are suggestive of the solution rather than final, but there will be much material that sustains them in the complete report, Volume II, Report of the Chief of the Weather Bureau, 1903–1904.

There are two conditions that modify the solutions of Case I and Case II very decisively. (1) The first is that the assumption that the angular momenta in the several strata remain constant around the earth, or that the air rotates in unbroken rings, does not hold good even approximately. Besides the waves and vortices engendered between discontinuous strata, as von Helmholtz explained, there is a yet more powful cause for the breaking down of the vortex law, $v\,\varpi =$ constant, namely, in the cyclones and the anticyclones of middle latitudes, and in the convectional vertical circulation near the equator. (2) The second is that the boundary between the eastward and the westward drift does not girdle the earth uniformly, but is broken up into sections by the intrusion of Case II into the region of Case I, and the extension of Case I into the region of Case II, so that the high pressure belt which this solution assumes to encircle the earth is broken up into large isolated high areas or centers of action, as those lying over the oceans in summer, or over the continents in winter, in the lower strata of the atmosphere. To work out the theory of these details will be a large task for the meteorologist of the future. These two types of disturbance operate together, somewhat as described in the Weather Bureau Cloud Report, 1898–1899, so that the present paper is merely an extension of the analysis there suggested. The following descriptive statement attempts to outline the probable course of the modifications of the pure vortex theory contained in the system of equations given above.

Referring to figs. 18 and 19, the "unmodified" and the "modified" systems, respectively, it is evident that the solar radiation in the Tropics, if unrelieved, will by accumulation raise the isobars of Case II, by increasing the potential temperature $\theta_2$ and the westward velocity $v_2 - v_0$ in the lower strata. In a circulating atmosphere the relief comes in two ways, (1) by forming a vertical convection near the equator, and (2) by forcing a horizontal convection into the lower strata

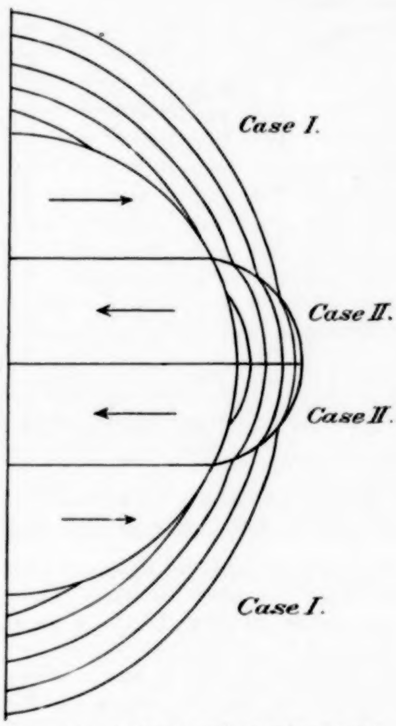



FIG. 18.—Cases I and II unmodified.

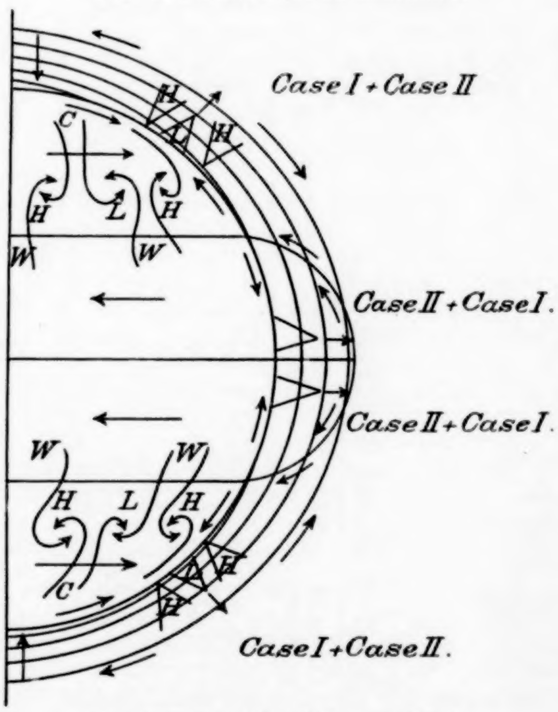



FIG. 19.—Cases I and II as modified.

of the temperate zones. The first transports heat into the upper strata, reducing $\theta_2$ and increasing $\theta_1$, so that the westward drift diminishes. At the same time the intrusion of masses of air having one value of momentum $(mv)_{II}$ into those having another value $(mv)_I$ will change their velocities. These two causes lower the lines of Case II on the equator side, and in the lower strata may even reverse them. Accompanying these changes a component on the meridian toward the equator sets in, so that the trades from the northeast and southeast are developed, and the first minor circulation is maintained in the sense indicated by the arrows over the tropical zone of fig. 19. The rise and fall of the isobars of Case II, with the relief of the incoming solar heat through this circulation, is a complex but sensitive form of natural heat governor which is self-regulating, and preserves the normal state of equilibrium proper for the season of the year. This special action is chiefly due to the mutual movement among the terms of equation (39) for Case II.

A still more complex system relates to the temperate zones and Case I. To some extent the terms within equation (38) for Case I go through a similar self-adjustment in response to the local insolation, but this is by no means the primary cause for the depression of the isobars of fig. 18 to those of fig. 19. As explained in my paper, "The mechanism of countercurrents of different temperatures in cyclones and anticyclones," MONTHLY WEATHER REVIEW, February, 1903, cyclones and anticyclones are formed by horizontal currents underflowing the prevailing eastward drift. Thus, as shown on fig. 19, warm currents flow from the Tropics into the Temperate Zone, as from the Gulf of Mexico into the United States, underneath the eastward drift, and this stratification of warm air beneath cold air produces two changes. The potential temperature $\theta_2$ is increased, the value $\theta_1 - \theta_2$ is diminished, the velocity is checked and the isobars fall, because the angular momentum is diminished. At the same time that the air rises on the east side of the cyclone, a cold current from the north flows to the west side, and this decreases its $\theta_2$ but increases the difference $\theta_1 - \theta_2$, so that the velocities are increased. It is known that the eastern warm current tends to curl westward and the western cold current tends to curl eastward about a cyclonic center; inverted conditions prevail around an anticyclonic center. Furthermore, the dynamic action of intruding cyclones and anticyclones from the lower to the higher strata, by their interchange of inertia with the eastward drift, must diminish the eastward velocity and lower the isobars of Case I. This effect of the interchange of components may be seen by combining the terms of Case I and Case II algebraically. Thus, we have, symbolically,

$$\left[\frac{+dr}{-d\varpi}\right]_{\text{Case I}} + \left[\frac{-dr}{-d\varpi}\right]_{\text{Case II}} = \left[\begin{matrix}\text{decrease of } (+dr) \\ \text{increase of } (-d\varpi)\end{matrix}\right]$$

so that the lines of Case I are plotted nearer the axis, and lower in the atmosphere above the horizon than in fig. 18. There are instances in which, by this intrusion of the warm air of Case II from the Tropics into the region of Case I, the potential temperature of the lower strata is greater than that of the higher strata, so that Case II supersedes Case I in the temperate zones with local westward winds. Similarly, the interplay of these cases outside their normal regions is a sufficient cause for the manifold local circulations found in the lower strata of the atmosphere up to about 3 miles from the ground, beyond which the circulation is more regular. The amount by which the normal lines of Case I are depressed through the intermixture of Cases I and II, in consequence of temperature and inertia interchanges in the lower strata, measures the amount by which the vortex law ceases to be complete in its application, and by which the Ferrel theory of the general circulation becomes an untenable hypothesis. In effect these interchanges are attended by secondary currents along the meridian so that there is a second minor circuit in the temperate zones, somewhat as indicated on fig. 19. The *H*, *L*, *H*, of the vertical section should be understood to stand over *H*, *L*, *H*, on the horizontal plane of the given latitude; that is, they are not distributed in latitude but in longitude, and should be superposed in a correct projection. So far as I understand the facts, this circulation, taken in connection with the tropical circuit, conforms to the results of the International Survey, as stated in H. H. Hildebrandson's Report, which need not be here recapitulated. In the polar zone our information is too meager to afford us very definite knowledge, but I suspect that there is a third circuit as shown in fig. 19, though it may not be very pronounced and well defined.

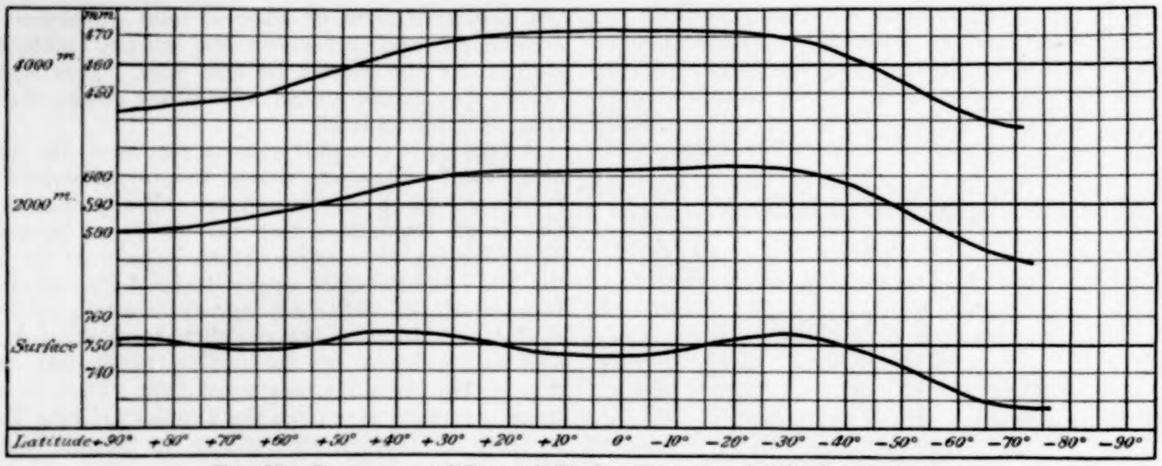



FIG. 20.—Pressures at different latitudes (Ferrel) and altitudes (Sprung).

It is my purpose to work out the data for the temperate and the tropical zones now in the possession of the Weather Bureau and applicable to the North American Continent, along the lines here indicated. The attempt to bring these laws of the general and the local circulations into a harmonious numerical scheme will require considerable labor, but it is believed that it can be accomplished. The data contained in my reports, while apparently somewhat disconnected, are in reality all contributory to my solution of the problems of atmospheric circulations both of the earth and of the sun, together with the connections between them. It is proper to determine carefully the separate portions of the work, i. e., the velocities and temperatures of the strata in motion as dependent upon observations, before trying to put them together in a final synthesis. It is only necessary to have in mind the general plan of development, as here outlined, in order to keep the several portions in harmonious relations with each other.

## CLIMATOLOGY OF COSTA RICA.

Communicated by Mr. H. PITTIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

*Notes on the weather.*—On the Pacific slope, the rainfall was without exception much above the normal. Violent and cold winds have been blowing almost continually, accompanied by mist and rain, which greatly hindered the coffee picking. In San José, pressure temperature and relative humidity were normal, but the rainfall exceeded six times the mean amount for the past fifteen years, 63 millimeters (2.48 inches) and eight days against 10 millimeters (0.39 inches) and three days. Notwithstanding the frequence of rain, the hours of sunshine were above the normal 220.3 against 199.6. The few reports received from the stations of the Atlantic slope indicate a remarkable scarcity of rain in contrast with the diluvial showers of December, 1903.

*Notes on earthquakes.*—January 14, $2^h\ 37^m$ a. m., slight shock E-W., intensity II, duration 6 seconds; $6^h\ 35^m$ p. m., tremors, apparently E-W., intensity I, duration 3 seconds. January 15, $3^h\ 54^m$ p. m., very slight shock E-W., intensity I, duration 4 seconds; $4^h\ 45^m$ p. m., tremors. January 16, $6^h\ 59^m$ p. m., strong shock E-W., intensity III, duration 2 seconds. January 20, $9^h\ 21^m$ a. m., strong shock E-W., intensity III, duration 6 seconds; $9^h\ 2^m$ p. m., slight shock E-W., intensity I, duration 2 seconds; $9^h\ 18^m$ p. m., shock E-W., intensity II, duration 10 seconds. January 23, $8^h\ 40^m$ p. m., strong shock E-W., intensity III, duration 10 seconds. January 24, $1^h\ 46^m$ a. m., slight shock E-W., intensity II, duration 4 seconds. January 25, $11^h\ 17^m$ p. m., slight shock E-W., intensity I, duration 3 seconds. January 31, $10^h\ 43^m$ p. m., slight shock ENE-WSW., intensity II, duration 3 seconds.

## ANNUAL CLIMATOLOGICAL SUMMARY FOR HAWAII.

By R. C. LYDECKER, Territorial Meteorologist.

The following is the rainfall for the year 1903 as gaged at the several stations of the Weather Bureau. The heaviest rainfall during the year was at Nahiku, Maui, at an elevation of 1600 feet. The rainfall here was 319.80 inches, or practically 26.6 feet. The next heaviest rainfall was at Puuohua, Hawaii, at an elevation of 1050 feet, 244.20 inches, or upwards of 20 feet.

Least rainfall, U. S. Magnetic Station, Sisal, Oahu, 8.19 inches.

Approximate percentage of district rainfall as compared with normal: Hawaii, Hilo district, 100 per cent; Hamakua, 110; Kohala, 98; Waimea, 86; Kona, 95; Kau, 62; Puna, 89; island of Maui, 130; island of Oahu, Honolulu district, 72; Nuuanu, 96; Koolau, 67; Ewa, 60; island of Kauai, 72.

| Stations. | Elevation. | Amount. | Stations. | Elevation. | Amount. |
|---|---|---|---|---|---|
| HAWAII. | | | | | |
| HILO, e. and ne. | *Feet.* | *Inches.* | MAUI.—Cont'd. | *Feet.* | *Inches.* |
| Waiakea | 50 | 118.89 | Puuomalei | 1,400 | 87.40 |
| Hilo (town) | 100 | 132.01 | Paia | 180 | 53.76 |
| Kaumana | 1,250 | 174.41 | Haleakala Ranch | 2,000 | 40.46 |
| Pepeekeo | 100 | 112.85 | Wailuku | 250 | 28.97 |
| Hakalau | 200 | 129.68 | OAHU. | | |
| Honohina | 300 | 145.40 | Punahou (W. B.), sw | 47 | 32.68 |
| Puuohua | 1,050 | 244.20 | Kulaokahua (Castle), sw | 50 | 22.00 |
| Laupahoehoe | 500 | 170.30 | Makiki Reservoir | 120 | 32.57 |
| Ookala | 400 | 105.53 | U. S. Naval Station, sw | 6 | 18.34 |
| HAMAKUA, ne. | | | Kapiolani Park, sw | 10 | 14.02 |
| Kukaiau | 250 | 97.29 | College Hills | 175 | 38.50 |
| Paauilo | 300 | 75.34 | Manoa (Woodlawn Dairy) e | 285 | 95.60 |
| Paauhau | 300 | 60.37 | Manoa (Rhodes Gardens) | 360 | 125.95 |
| Honokaa (Mill) | 425 | 68.45 | Insane Asylum | 30 | 28.19 |
| Honokaa (Meinicke) | 1,100 | 91.52 | Kalihi-uka | 485 | 98.29 |
| Kukuihaele | 700 | 75.04 | Nunanu (W. W. Hall), sw | 50 | 35.58 |
| KOHALA, n. | | | Nuuanu (Wyllie street) | 250 | 54.75 |
| Niulii | 200 | 53.60 | Nuuanu (Elec. Station), so. | 405 | 56.08 |
| Kohala (Mission) | 521 | 51.92 | Nuuanu (Luakaha), e | 850 | 145.73 |
| Kohala (Sugar Co.) | 270 | 48.45 | U. S. Experiment Station | 350 | 45.19 |
| Hawi Mill | 700 | 51.34 | Kaliula | 1,150 | 95.08 |
| Puakea Ranch | 600 | 38.07 | Tantalus Heights (Frear) | 1,360 | 107.22 |
| Puuhue Ranch | 1,847 | 38.88 | Waimanalo, ne | 25 | 28.31 |
| Waimea | 2,720 | 35.00 | Maunawili, ne | 300 | 68.42 |
| KONA, w. | | | Kaneohe | 100 | 41.51 |
| Holualoa | 1,350 | 56.11 | Ahuimanu, ne | 350 | 73.59 |
| Kealakekua | 1,580 | 63.22 | Kahuku, n | 25 | 19.40 |
| Napoopoo | 25 | 31.25 | Wahiawa | 900 | 35.62 |
| Hoopuloa | 1,650 | 45.96 | Ewa Plantation, s | 60 | 12.40 |
| Hoopuloa | 2,300 | 65.37 | U. S. Magnetic Station | 45 | 8.19 |
| KAU, se. | | | Waipahu | 200 | 9.30 |
| Kahuku Ranch | 1,680 | 24.42 | Moanalua | 15 | 27.85 |
| Honuapo | 15 | 19.32 | KAUAI. | | |
| Naalehu | 650 | 29.05 | Lihue (Grove Farm), e | 200 | 32.06 |
| Hilea | 310 | 24.97 | Lihue (Molokoa), e | 300 | 33.61 |
| Pahala | 850 | 31.60 | Lihue (Kukaua), e | 1,000 | 71.19 |
| Volcano House | 4,000 | 67.44 | Lihue (Kilohana) | 400 | 38.25 |
| PUNA, e. | | | Kealia, e | 15 | 16.66 |
| Kapoho | 110 | 72.41 | Kilauea Plantation, ne | 325 | 47.34 |
| Pahoa | 600 | 121.10 | Hanalei, n | 10 | 80.51 |
| MAUI. | | | Waiawa | 32 | 10.35 |
| Waiopae Ranch | 700 | 11.95 | Eleele | 150 | 20.86 |
| Kaupo (Mokulau) s | 285 | 72.23 | Wahiawa (Mountain) | 3,000 | 142.45 |
| Kipahulu | 308 | 80.32 | McBryde (Residence) | 850 | 53.41 |
| Nahiku | 1,600 | 319.80 | Lawai (Government Road) | 450 | 61.92 |
| Haiku | 700 | 85.40 | Lawai, w | 225 | 26.60 |
| Kula (Erehwon) | 4,500 | 35.06 | Lawai, e | 800 | 58.98 |
| Kula Waiakoa | 2,700 | 18.70 | Koloa | 100 | 29.87 |

*Summary of observations at the Weather Bureau station, Honolulu, Hawaii, for 1903.*

Latitude 21° 18′ north. Longitude 157° 50′ west. Ground above sea, 43 feet. Thermometer above ground, 9; barometer 7 feet. Rain gage above ground, 1 foot. Exposure southwest.

| Month. | Precipitation. | | | | Temperature. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Average, 1903. | | | | | | | Normal mean. | 1903. | | |
| | 1903. | Normal. | No. days. | Normal. | 6 a. m. | 9 a. m. | 2 p. m. | 9 p. m. | Min. | Max. | Mean. | | Lowest. | Highest. | Mean daily range. |
| January | 4.05 | 3.10 | 12 | 16 | 67.0 | 71.8 | 74.4 | 68.0 | 63.5 | 75.5 | 69.8 | 70.3 | 56 | 79 | 12.0 |
| February | 5.86 | 5.48 | 12 | 15 | 64.1 | 69.1 | 71.9 | 66.2 | 61.3 | 73.2 | 67.3 | 70.2 | 53 | 76 | 11.9 |
| March | 1.03 | 3.76 | 9 | 18 | 63.0 | 70.4 | 73.0 | 66.1 | 61.3 | 74.5 | 67.3 | 70.7 | 56 | 78 | 13.2 |
| April | 2.35 | 2.90 | 25 | 17 | 69.1 | 74.1 | 75.7 | 70.9 | 67.0 | 77.0 | 71.9 | 72.5 | 61 | 82 | 10.0 |
| May | 1.86 | 2.68 | 25 | 19 | 71.3 | 76.3 | 78.3 | 72.9 | 69.0 | 80.0 | 74.2 | 74.1 | 66 | 83 | 11.0 |
| June | 1.36 | 1.52 | 15 | 19 | 72.9 | 78.1 | 80.7 | 74.3 | 69.9 | 82.2 | 76.0 | 76.0 | 65 | 85 | 12.0 |
| July | 2.08 | 1.72 | 22 | 19 | 72.8 | 78.8 | 81.6 | 73.7 | 72.8 | 83.0 | 77.6 | 77.3 | 70 | 87 | 10.2 |
| August | 2.48 | 1.97 | 24 | 18 | 75.4 | 78.8 | 82.5 | 76.3 | 72.8 | 83.4 | 77.9 | 77.7 | 70 | 85 | 10.5 |
| September | 5.74 | 1.98 | 19 | 18 | 75.0 | 79.1 | 81.5 | 76.0 | 72.6 | 83.0 | 77.5 | 77.5 | 69 | 84 | 10.3 |
| October | 2.17 | 2.76 | 17 | 19 | 72.0 | 77.3 | 79.2 | 74.0 | 70.3 | 80.4 | 75.1 | 76.2 | 64 | 83 | 10.1 |
| November | 2.26 | 5.15 | 16 | 17 | 70.8 | 75.9 | 77.6 | 72.5 | 69.2 | 78.9 | 73.6 | 73.8 | 63 | 82 | 9.7 |
| December | 1.44 | 3.92 | 11 | 16 | 68.0 | 74.6 | 77.6 | 71.0 | 67.0 | 78.4 | 72.2 | 71.5 | 62 | 80 | 11.4 |
| Year | 32.68 | 36.95 | 207 | 211 | 70.1 | 75.4 | 77.8 | 71.8 | 68.1 | 79.1 | 73.4 | 74.0 | 53 | 87 | 11.0 |

| Month. | Barometer. | | | | | | | Humidity means. | | | | | | Direction of wind | | | | Normal days of trade wind. | Wind force. | Cloudiness in tenths. | Normal cloudiness. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average, 1903. | | | | Normal mean. | 1903. | | | | | | | | | | | | | | | |
| | 9 a. m. | 3 p. m. | 9 p. m. | Mean. | | Highest. | Lowest. | Grs. of moisture per c. ft. | Normal. | Mean dew point. | Mean normal. | Relative humidity. | Normal humidity. | NE. quadrant. | SE. quadrant. | SW. quadrant. | NW. quadrant. | | | | |
| January | 30.070 | 29.970 | 30.047 | 30.020 | 29.972 | 30.22 | 29.72 | 5.89 | 6.27 | 60.5 | 62.5 | 73.8 | 76.7 | 15 | 7 | 4 | 5 | 14 | 2.1 | 4.5 | 4.4 |
| February | 30.048 | 29.957 | 30.034 | 30.003 | 29.966 | 30.21 | 29.66 | 5.24 | 6.24 | 57.0 | 62.5 | 71.4 | 76.7 | 17 | 0 | 5 | 6 | 15 | 2.7 | 4.7 | 4.9 |
| March | 30.011 | 29.930 | 30.004 | 29.970 | 30.010 | 30.17 | 29.77 | 5.32 | 6.05 | 57.5 | 61.5 | 72.3 | 71.7 | 15 | 1 | 10 | 5 | 18 | 1.8 | 4.2 | 4.6 |
| April | 30.042 | 29.968 | 30.047 | 30.005 | 30.029 | 30.15 | 29.88 | 6.22 | 6.42 | 62.3 | 63.5 | 72.8 | 73.0 | 27 | 2 | 1 | 0 | 20 | 3.2 | 5.1 | 5.1 |
| May | 30.078 | 30.010 | 30.082 | 30.044 | 30.030 | 30.15 | 29.94 | 6.39 | 6.53 | 63.2 | 63.9 | 69.7 | 72.5 | 26 | 4 | 1 | 0 | 24 | 3.0 | 4.8 | 4.4 |
| June | 30.017 | 29.961 | 30.016 | 29.989 | 30.009 | 30.12 | 29.98 | 6.74 | 6.83 | 64.9 | 65.0 | 70.1 | 70.7 | 28 | 0 | 2 | 0 | 26 | 2.3 | 3.8 | 4.0 |
| July | 30.025 | 29.976 | 30.016 | 30.000 | 29.995 | 30.09 | 29.91 | 6.73 | 6.81 | 65.0 | 65.0 | 67.9 | 68.5 | 30 | 0 | 0 | 1 | 29 | 3.1 | 3.2 | 4.0 |
| August | 30.032 | 29.971 | 30.026 | 30.001 | 29.980 | 30.08 | 29.94 | 7.07 | 7.01 | 66.5 | 66.0 | 70.0 | 68.5 | 31 | 0 | 0 | 0 | 29 | 2.1 | 4.1 | 4.0 |
| September | 30.024 | 29.957 | 30.023 | 29.991 | 29.968 | 30.08 | 29.90 | 6.96 | 7.06 | 66.1 | 66.0 | 69.7 | 68.5 | 30 | 0 | 0 | 0 | 26 | 2.3 | 3.5 | 4.0 |
| October | 30.007 | 29.938 | 30.004 | 29.972 | 29.968 | 30.07 | 29.72 | 6.87 | 7.06 | 65.6 | 66.0 | 73.9 | 70.5 | 23 | 2 | 6 | 0 | 22 | 2.2 | 4.3 | 4.3 |
| November | 30.028 | 29.953 | 30.019 | 29.990 | 29.958 | 30.10 | 29.85 | 6.49 | 6.93 | 63.8 | 65.7 | 73.1 | 75.8 | 25 | 0 | 5 | 0 | 17 | 1.3 | 3.5 | 4.8 |
| December | 30.035 | 29.960 | 30.022 | 29.998 | 29.969 | 30.13 | 29.84 | 6.42 | 6.32 | 63.5 | 63.0 | 75.8 | 73.8 | 24 | 0 | 7 | 0 | 16 | 1.0 | 2.9 | 4.4 |
| Year | 30.035 | 29.963 | 30.028 | 29.999 | 29.988 | 30.22 | 29.66 | 6.36 | 6.63 | 63.0 | 64.2 | 71.7 | 72.2 | 291 | 16 | 41 | 17 | 256 | 2.3 | 4.05 | 4.37 |

Temperature mean = (6 + 2 + 9) ÷ 3. Observations are taken in standard time of 157° 50′ west of Greenwich.
Pressure corrected for temperature and reduced to sea level, and the gravity correction —.06, applied. Mean = (9 + 3) ÷ 2.
Direction of wind. Each quadrant includes the cardinal point to the right of it, i. e., NE. includes E., etc. Force of wind, Beaufort scale, and during daylight.

## JULIUS R. FREDERICK.

Julius R. Frederick was born at Dayton, Ohio, July 21, 1852, Thirteen years later he entered service as a messenger in Chicago, and within six years he became, successively, a brakeman, fireman, and engineer in the employ of the Pennsylvania Railroad, and remained in the last-named position until 1874, when, as a participant in the great strike, he left the company's service, although offered a life position to remain. He enlisted in the Army September 11, 1876, and served through the Sioux and Nez Perces wars. His superior physique and the good judgment and courage displayed by him in those wars doubtless prompted his assignment to the Lady Franklin Bay Expedition in April, 1881. The story of that unfortunate voyage bears frequent mention of Frederick's name in words of praise, admiration, and gratitude. A single incident, taken from the official report, will perhaps best illustrate his character. While at Camp Clay, on the last fearful days of that expedition, it was thought necessary to make an effort to recover 100 pounds of beef left at Bairds Inlet the year before. For this service Frederick and another member of the expeditionary force volunteered, Lieutenant Greely consenting reluctantly, fearing fatal results to the men in their enfeebled condition. They set out on the 6th of April, and, after encountering severe storms, reached their destination only to find no trace of the beef. Sadly disappointed, but courageously, they set out on their return. In a short time his companion began to fail, and soon died in Frederick's arms. After burying him as best he could, Frederick resumed his journey to camp. He says at this time he felt more like remaining to perish by the side of his companion than like making another effort; but the thought of those who would be sent out to find him if he did not return spurred him to continued exertions, and he reached camp on the 13th.

Frederick distinguished himself in this disastrous journey, and brought in the entire load hauled out by the two, and, remarkable to say, did his work on the scanty ration of 6 ounces of meat and 6 ounces of bread, not availing himself of the additional increase authorized in case of extraordinary circumstances.

Among other encomiums from his commanding officer, is the following:

His extremely valuable services as one of the supporting party to the "Farthest North", as engineer at the critical point of our retreat, as cook during the terrible winter, and as hunter and general worker in the more disastrous spring, all showed the stamp of no ordinary man.

Frederick entered the meteorological branch of the Signal Corps August 1, 1884, by transfer from the line of the Army, and, by an act of Congress, approved June 21, 1902, was placed on the retired list of the Army as a first-class sergeant, Signal Corps.

After his transfer he was first detailed for special duty at Portsmouth, N. H., and afterwards at Washington, D. C., and on the 9th day of February, 1885, he was assigned as assistant at Indianapolis, Ind., where he remained in the Signal and Weather Bureau Services until the time of his death, January 6, 1904, enjoying the respect and esteem of all who knew him.—*D. J. C.*

# NOTES AND EXTRACTS.

## METEOROLOGY IN SERVIA.

The meteorological service of Servia was organized by Prof. Milan Nedelkovitch, and has been maintained by his personal efforts since 1887, when the observatory was founded at Belgrade. Step by step he has added stations of the second order, until now there are 18 of these, 4 of which are furnished with self-registering apparatus for pressure, temperature, and rain. There are also 44 stations of the third class, and 117 of the fourth. The annual appropriation for expenses is 10,000 francs for the salaries of observers and necessary expenses at the central observatory and the other stations; 2000 francs for the printing of the monthly bulletin; 3000 or 4000 francs for those primary schools that maintain meteorological stations; 10,000 or 12,000 francs for the various local governments (corresponding to our counties and cities) to defray their expenses in the matter of meteorology. The regular publications of the central observatory are the monthly bulletins and the annual volumes. The bulletin gives, in that detail which is demanded by modern climatology, all monthly data relative to the atmosphere, not only the pressure, moisture, temperature, cloudiness, wind, and rain, but also in many cases the records of the heliograph and the actinometer, and especially the temperature of the soil at various depths beneath the surface, 24 in all, from 0.01 meter (0.4 inch) down to 24 meters (78 feet). This is undoubtedly the most important series of soil temperatures ever yet undertaken, and arrangements should be made for keeping it up indefinitely for as many years as possible. We ought, however, to add that as a check against the uncertainties of deep thermometers, it is very desirable that electric thermometers, more especially the thermophone of Warren and Whipple, be established at several different depths and read simultaneously with the Lamont mercurials.

The Arago-Davy actinometer, or bright bulb and black bulb

in vacuo, is read hourly during the daytime. Parallel with this are the readings of the heliograph, so that we have both the intensity and duration of the sunshine. Apparently the heliograph is of the Campbell-Stokes pattern, in which the sun's rays, concentrated by a lens, char a bit of wood or cardboard. Of course these forms of apparatus still need to be supplemented by the more recent and very convenient actinometers of Ångström, Chwolson, or Violle. If this can be done at Belgrade, that observatory will surpass all others in the value of its sunshine records. The record of the heliograph shows that the total duration of bright sunshine was 2303.8 hours during 1902, or 48 per cent of the total possible. The average reading of the black bulb in vacuo was 24.85° C., and of the bright bulb in vacuo 15.88° C. The maximum reading of the black bulb was 39.42° C. The average temperature of a thermometer in the shade was 10.81° C. and in full sunshine 10.95° C. These two latter figures are the averages for day and night, and the temperatures of an unsheltered thermometer are as certain to be below the true temperature of the air by night as they are above it by day. The annual evaporation from a water surface within a thermometer shelter was 67.3 millimeters, while the annual rainfall at the station during 1902 was 563 millimeters. Of course the evaporation would be much larger if the water surface was outside the shelter and fully exposed to the sunshine and wind. Being within the shelter, the evaporation of 67.3 millimeters must be correlated with the observations of the wet-bulb thermometer. This latter, or the psychrometer, is observed regularly, and, as no artificial ventilation is employed, the evaporation from its surface will only differ from that shown by the plane water surface of the evaporometer by reason of the texture of the muslin surface, and possibly the more or less perfect supply of water to the muslin covering. According to the formula of Fitzgerald, we may compute the average humidity of the air from the rate of evaporation, viz, the average vapor tension equals the vapor tension corresponding to the temperature of the water, which in this case is the temperature of the wet bulb, minus the expression $CE/(1+1/2W)$, where $E$ is the quantity evaporated in one hour, and $W$ is the velocity of the wind per hour. The coefficients $C$ and $1/2$ need to be determined in each special case, and it is to be hoped that some addition to our knowledge may be secured by making such determinations frequently at the Belgrade Observatory.

*Mean temperatures of the soil at various depths at Belgrade, Servia.*

| Depth. | 1902 August. | 1902 December | 1902 Annual. | Depth. | 1902 August. | 1902 December | 1902 Annual. |
|---|---|---|---|---|---|---|---|
| *Meters.* | ° C. | ° C. | ° C. | *Meters.* | ° C. | ° C. | ° C. |
| 0.01 | 24.52 | 0.70 | 12.51 | 3.00 | 14.56 | 12.61 | 12.59 |
| 0.05 | 24.19 | 0.74 | 12.28 | 4.00 | 13.83 | 13.54 | 12.75 |
| 0.10 | 24.27 | 0.74 | 12.25 | 5.00 | 12.90 | 13.65 | 12.69 |
| 0.15 | 23.82 | 1.02 | 12.21 | 6.00 | 12.28 | 13.50 | 12.72 |
| 0.20 | 23.41 | 1.53 | 12.24 | 8.00 | 12.60 | 12.97 | 12.81 |
| 0.30 | 22.64 | 1.66 | 12.20 | 10.00 | 12.80 | 12.80 | 12.83 |
| 0.50 | 22.34 | 3.17 | 12.54 | 12.00 | 12.90 | 12.80 | 12.89 |
| 0.60 | 21.77 | 3.91 | 12.55 | 14.00 | 12.90 | 12.90 | 12.90 |
| 0.90 | 20.79 | 6.18 | 12.86 | 16.00 | 13.00 | 13.00 | 13.00 |
| 1.20 | 19.20 | 8.17 | 12.72 | 18.00 | 13.00 | 13.00 | 13.00 |
| 1.50 | 18.73 | 8.50 | 12.57 | 20.00 | 13.10 | 13.10 | 13.09 |
| 2.00 | 17.22 | 10.58 | 12.68 | 24.00 | 13.30 | 13.20 | 13.30 |

In his introductory note of August 20, 1903, Nedelkovitch announces that through the kindness of Konkoly he is about to establish a Vincentini seismometer as modified by Konkoly himself, and constructed at the workshop of the meteorological institution at Budapest. To Konkoly also he is indebted for the magnetic apparatus constructed on Lamont's system, so that Belgrade is now able to carry on all the works that are considered appropriate to a modern meteorological establishment. Of course, magnetism and seismology are not essentially meteorological, but it is important that the records be kept, and it is convenient to have the meteorologists do this. The same may be said of the temperatures of the soil and of the waters of the lakes and oceans, but these have some important connection with meteorology. The remarkable series of soil temperatures maintained at Belgrade, and published in daily and monthly means, shows that in the year 1902 the lowest temperature at the surface of the soil occurred on January 21, namely, —0.28° C. The highest temperature at the surface of the soil occurred August 9, 28.43° C. The mean monthly temperatures are given in full in the annual summary, and we reproduce in the preceding table the means for the months that have the highest and the lowest surface temperatures, namely, August and December, and also the annual mean.

## THE CLIMATE OF SOUTHWESTERN IDAHO.

At a meeting of the Idaho State Horticultural Society on January 17, 1902, Mr. S. M. Blandford, Section Director, read an interesting paper on "Mildness of the climate of southwestern Idaho."

He states that the exceptionally mild section of Idaho may be said to extend from Shoshone, Lincoln County, in the Snake River basin, on the south to Lewiston, Nez Perces County, on the Clear Water River, on the north. Adopting the temperature of Boise, Ada County, as fairly representing the average temperature for this southwest valley section, and comparing it with the temperatures of other cities on about the same parallel of latitude, he shows it to be very considerably warmer. Thus, the annual mean temperature of Boise is 51°, while that of Milwaukee, Wis., is 46°. Going farther south, Salt Lake City, Utah, has an annual mean temperature of 51°, or the same as Boise; Pocatello, Wyo., 46; Cheyenne, Wyo., 44; Santa Fe., N. Mex., 48°.

Comparing with stations to the westward, Baker City, Oreg., has an annual mean temperature of 45°; Portland, Oreg., 52°; Roseburg, Oreg., 53°; Eureka, Cal., 51°; San Francisco, Cal., 56°; San Louis Obispo, Cal., 58°, the last two being, of course, farther south than Boise.

Lewiston has an average annual temperature of 53°; Garnet, on Snake River, 56°.

Mr. Blandford also mentions the light winds as a feature of the climate, Boise and Lewiston records showing an average velocity for the year of 4 miles per hour.

In discussing the causes of the extreme mildness of this section, Mr. Blandford says:

> The valley of the Snake River, from a topographical view, is a trough in the great American Plateau. For 400 miles eastward from its intersection with the western boundary of the State the surface of this valley ranges from 1000 to 4000 feet above sea level, while the mountains that surround it on the north, east, south, and west vary in height from 6000 to 10,000 feet. Briefly, these are the prominent topographical characteristics of the State of Idaho that bear on our subject.
>
> From the foregoing it is clear that the air in reaching the Snake River basin and neighboring valleys must flow over the summits of mountains and descend, and consequently be compressed, thereby having its temperature raised. * * * There is no possible way for air entering Snake River basin and adjacent valleys to escape this compression and warming, except it enter from the northwest through the narrow gorge of the Snake River. The residents in the Boise, Payette, or Snake River Valley will observe that the southerly, easterly, and northerly winds are the warm winds, while the northwesterly wind is almost invariably cool.

Mr. Blandford then goes on to discuss the effect of mountain ranges upon the temperature of air currents blowing over them. The printed abstract of his remarks seems to have been too brief and needs to be supplemented by an important consideration. The current of air that ascends the windward side of a mountain is cooling by reason of its expansion as it comes under lower barometric pressure. It cools at a nearly uniform rate, approximately the adiabatic rate, which is about 1° C. to 100 meters, or 1° F. for 186 feet of ascent. But when, finally, it has cooled to the dew-point, and haze or cloud begins to be formed, and rain or snow falls, an appreciable amount of heat that was before latent is now retained by the cloud, while the rain or snow falls to the ground. When the cloud passes the

mountain crest and begins to descend, the air is warmed by compression at the same rate as before. The cloud is soon evaporated and the air becomes clear, but as it continues to descend it is frequently much warmer than it was at the same level on the windward side. Doubtless heat is lost by radiation during the descent, but it is also being lost during the ascent, so that, as a general rule, the descending winds on the leeward side must be warmer and drier than the ascending winds on the windward side in proportion to the amount of moisture lost and latent heat retained, and also in proportion to the excess of gain by insolation over loss by radiation.

These descending warm winds are usually called "chinook winds" in the Rocky and Cascade mountains, while in the Alps they are called Foehn winds. Mr. Blandford says:

These warm winds * * * always come from the direction of the mountains. In Montana the chinook is a westerly wind, while in Idaho it comes from any direction except west. At Boise it comes from the east.

We should assign the mildness of the climate of southwestern Idaho to local causes rather than to a supposed current in the Pacific a thousand miles to the westward.

## FLOW OF SPRING WATER AFTER FIRST KILLING FROST.

Mr. Woodruff Ball, of Nebraska, has submitted to Mr. H. McP. Baldwin, Assistant Observer in charge of the Weather Bureau station at Valentine, Nebr., some interesting observations, which are corroborated by the testimony of a number of other persons, about as follows:

Natural springs of water in the region where Mr. Ball lives, about fifty miles south of Valentine, are observed to rise or increase their volume about the time of the first killing frost, which is about the 15th of September. The flow continues through fall, winter, and spring. The springs generally begin to show a perceptible decrease about the first of June. It is not known how far below the soil the springs originate, but the rise in the well water is noticeable.

Any explanation of the above phenomenon must involve geological considerations, combined with the time and quantity of rainfall. We shall be glad if those who are familiar with the geological structure underlying Nebraska would elucidate this matter for the benefit of the readers of the WEATHER REVIEW.

## AN OLD DESCRIPTION OF AMERICAN CLIMATES.

Our attention has recently been called to a description of the climate of different sections of the eastern part of the United States in Carey's American Pocket Atlas, published in Philadelphia in 1796, from which the following extracts have been obtained, and these apply as well to the present time as they do to the eighteenth century:

*Page 13. New England; climate and diseases.*—New England has a very healthful climate. It is estimated that one in seven of the inhabitants live to the age of 70 years, and one in thirteen or fourteen to 80 years and upward.

Winter commonly commences in its severity about the middle of December; sometimes earlier, and sometimes not till Christmas. Cattle are fed or housed in the northern parts of New England from about the 20th of November to the 20th of May; in the southern parts not quite so long.

*Pages 45-46.*—The Second Grand Division of the United States comprehends: New York, New Jersey, Pennsylvania, Delaware, and the Territory northwest of Ohio. It is bounded north by upper Canada, from which it is separated by the lakes; east by the New England States; south by the Atlantic Ocean, Maryland, Virginia, and the Ohio River, which separates it from Kentucky; west by the Mississippi River.

* * * * * * *

*Climate.*—The climate of this Grand Division, lying almost in the same latitudes, varies but little from that of New England. There are no two successive years alike. Even the same successive seasons and months differ from each other every year. And there is perhaps but one steady trait in the character of this climate, and that is, it is uniformly variable. The changes of weather are great and frequently sudden.[1]

There are seldom more than four months in the year in which the weather is agreeable without a fire. In winter the winds generally come from the northwest in fair and from the northeast in wet weather. The northwest winds are uncommonly dry as well as cold. The climate on the west side of the Allegheny Mountains differs materially from that on the east side, in the temperature of the air, and the effects of the wind upon the weather, and in the quantity of rain and snow which falls every year. The southwest winds on the west side of the mountains are accompanied by cold and rain. The temperature of the air is seldom so cold or so hot, by several degrees, as on the east side of the mountains.

On the whole, it appears that the climate of this division of the United States is a compound of most of the climates in the world; it has the moisture of Ireland in the spring; the heat of Africa in summer; the temperature of Italy in June; the sky of Egypt in autumn; the snow and cold of Norway, and the ice of Holland, in winter; the tempests (in a certain degree) of the West Indies in every season, and the variable winds and weather of Great Britain in every month of the year.

From this account of the climate of this district it is easy to ascertain what degree of health and what diseases prevail. As the inhabitants have the climates, so they have the acute diseases of all the countries that have been mentioned. Although it might be supposed that with such changes and varieties in the weather there would be contracted epidemical diseases and an unwholesome climate, yet on the whole, it is found in this district to be as healthy as any part of the United States.

*Page 91. Maryland.*—Here are also large tracts of marsh, which during the day load the atmosphere with vapor that falls in dew in the close of the summer and fall seasons, which are sickly. The spring and summer are mostly healthy.

*Page 96. Virginia; climate.*—It is remarkable that, proceeding on the same parallel of latitude westerly, the climate becomes colder in like manner as when we proceeded northward. This continues to be the case till we attain the summit of the Alleghenies, which is the highest between the sea and the Mississippi. From thence, descending in the same latitude to the Mississippi, the change reverses, and it becomes warmer there than it is in the same latitude on the sea side.

*Page 100. Kentucky; climate.*—Healthy and delightful, some few places in the neighborhood of ponds and low ground excepted. The inhabitants do not experience the extremes of heat and cold. Snow seldom falls deep or lays long. The winter, which begins at Christmas, is never longer than three months, and it is commonly but two, and is so mild that cattle can subsist without fodder.

*Page 107. Tennessee; climate.*—Temperate and healthy. In the tract lying between the Great Island, as it is called, and the Kanawha, the summers are remarkably cool and the air rather moist. Southwest of this, as far as the Indian towns, the climate is much warmer, and the soil better adapted to the products of the Southern States.

## ON LIGHTNING RODS.

Mr. Henry P. Curtis, of Boston, writes to the Editor on the efficacy of lightning rods. He mentions several large hotels, scientifically protected by lightning conductors, that remained unscathed in a region of violent thunderstorms where he, at the same time, personally witnessed the destruction of unprotected buildings. One landlord said:

He could charge a Leyden jar by holding it close to the foot of one of the conductors in a thunderstorm.

Mr. Curtis describes his experience during a thunderstorm at a mountain hotel in New York. He was standing on the piazza when—

The most tremendous shock or concussion conceivable took place. I had a sudden sun dazzle in the eyes, a bitter taste in the mouth, a violent singing in the ears, a pungent sulphurous odor in the nose, and a severe headache. Then I learned that the house had been struck by lightning, that is to say, that the conductors had functioned effectively and had safely conducted the electricity into the lake, instead of the discharge falling upon the hotel and wrecking it.

## FOREST FIRES IN NOVEMBER, 1819.

We are indebted to Mr. Albert Matthews for the following extracts from the old files of a Boston paper, the Columbian Centinel, relative to the forest fires of November, 1819.

From the Columbian Centinel, Wednesday, November 24, 1819, No. 3717, pp. 2-3:

The late smoky atmosphere was experienced at nearly the same time far at sea, in the Canadas, and in the Eastern, Western, and Southern States, attended with colored rain. At sea the mariners found it difficult to take observations. The appearance was the most *murky* in Canada, where a general dread appears to have prevailed; and it is reported that many of the inhabitants of Montreal, in expectation that the darkness was a forerunner of an earthquake which would engulph their city, actu-

[1] See Monthly Weather Review for January, 1902. Vol. XXX, p. 19, note 2. Carey evidently took this sentence from Dr. Rush's article.—ED.

ally left it and fled to the neighboring towns. The Montreal papers contain whole columns of accounts of the "astonishing appearances," and it was conjectured that they were occasioned by eruptions of some neighboring volcano, and it was assured that during the darkness there were three shocks of an earthquake.

*Smoky atmosphere.*—Letters from Louisville, Ky., inform us that a great part of the woods between that place and Lexington, a distance of 74 miles, were in a blaze; and at Louisville the inhabitants had been nearly suffocated with smoke. * * * In North Carolina the smoky atmosphere was attributed to woods on fire in that State. The same in Canada.

From the Columbian Centinel of Wednesday, December 8, 1819, No. 3721, pp. 1, 3.

SOUTH CAROLINA, CHARLESTON, *November 25.*

*Smoky atmosphere.*—We have Bermuda papers of the 6th instant. They complain much of the smoky appearance and scent of their atmosphere, which some conjectured to have been occasioned by a great fire on the American Continent; and others, to be exhalations of the Gulph Stream.

## PLANT LIFE AND RAINFALL.

The vegetation indigenous to any region having long since adapted itself to the climate of that locality, it follows that the occasional extremes of temperature, rainfall, drought, etc., that are injurious to indigenous vegetation must have some relation to the ability of the plant to adapt itself to the normal climate and its normal variability.

Thus, fifty-four years at San Francisco give an average annual rainfall of 22.74 inches; forty-one years at Salt Lake City give 17.47 inches; thirty years at Denver give 14.07 inches. The corresponding annual variability or the probable variation of any year from the mean is $\pm 4.00$, 4.50, and 5.00 inches, respectively. This probable variation indicates that the annual values vary so much that there is an even chance that any year at San Francisco will have a rainfall either between 26.74 and 18.74 inches, or beyond these limits. For Salt Lake City these figures become 21.97 and 12.97 inches; for Denver the figures are 9.07 and 19.07 inches. Of course, therefore, at San Francisco 18.83 inches would correspond to a dry year, but not necessarily to a drought destructive to indigenous plants, because delicate plants must long since have died out or have learned to adapt themselves to such average dry years, and a really destructive drought must be something still more severe. During the fifty-four calendar years of San Francisco records, there has been one year with the rainfall 11.37 inches, or 50 per cent of the average, and the general distribution of rainfall is shown in the following table:

TABLE 1.—*Precipitation by calendar years.*

| Percentage of normal. | | Precipitation, in inches. | Number of years. | |
|---|---|---|---|---|
| Wet years, above 100 per cent. | | Over 22.74 | | 22 |
| Dry years.... | 100-90 per cent. | 22.74-20.47 | 13 | 32 |
| | 90-80 per cent. | 20.47-18.19 | 7 | |
| | 80-70 per cent. | 18.19-15.92 | 5 | |
| | 70-60 per cent. | 15.92-13.65 | 5 | |
| | 60-50 per cent. | 13.65-11.37 | 1 | |
| | 50- 0 per cent. | 11.27- 0 | 1 | |
| | | | | 54 |

If we consider the valuable crop plants that have been introduced into California and whose prosperity depends upon the winter rainfall, namely, October to April, inclusive, then we must sum up the rainfall for the crop year, July–June, inclusive, rather than for the calendar year, January–December. Tables of this kind, given by Professor McAdie, show that the average annual rainfall is 22.74 inches, the same as before, but the frequency of dry years occurs as in Table 2.

Therefore, there have altogether been fewer dry seasons. Yet these show a greater number of severe droughts than are shown by the calendar years.

We must now further distinguish between a meteorological or climatological drought and an agricultural drought. Thus, Professor McAdie states that the year 1885, with a rainfall of 24.90 inches in the calendar year, but of 18.10 inches in the crop year, 1884–85, was an agricultural drought and that the wheat yield was the lowest in twenty years. Again, the year July, 1881–June, 1882, gave a seasonal rainfall of 16.14 and the next year July, 1882–June, 1883, gave a rainfall of 20.12 inches, and yet these were good wheat years. The moisture in the soil, the irrigation, and the area covered by wheat, is not ordinarily considered by the climatologist. He confines his studies to precipitation data, and speaks of dry and wet years without reference to agricultural statistics.

TABLE 2.—*Precipitation by crop years.*

| Percentage of normal. | | Precipitation, in inches. | Number of years. | |
|---|---|---|---|---|
| Wet years, above 100 per cent. | | ............... | | 26 |
| Dry years.... | 100-90 per cent | 22.74-20.47 | 7 | 28 |
| | 90-80 per cent. | 20.47-18.19 | 9 | |
| | 80-70 per cent. | 18.19-15.92 | 6 | |
| | 70-60 per cent. | 15.92-13.65 | 1 | |
| | 60-50 per cent. | 13.65-11.37 | 1 | |
| | 50- 0 per cent. | 11.37- 0 | 4 | |
| | | | | 54 |

## OCEAN WAVE AT HONOLULU, HAWAII.

Rev. Dr. Sereno E. Bishop, well known as the first observer of Bishop's circle, writes from Honolulu under date of December 4, 1903:

On November 29 the self-recording tide gage in this harbor recorded several high and low tides in succession only a few minutes apart.

These are ocean waves, believed to be due to earthquakes, and to have traveled several thousand miles across the Pacific. Similar waves are known in former times to have come from Peru, from Japan, and from Krakatoa. The direction of the source of these last waves is determined by the fact that there were slightly damaging inundations along the north shore of the island of Oahu and also along the north shore of Molokai on the same day. Dr. Bishop therefore thinks it probable that these waves originated in the volcanic regions of the Aleutian Islands or of western Alaska. The seismograph at the United States magnetic station, some 20 miles from Honolulu, also recorded a very distinct convulsion of the earth at about the same time. Dr. Bishop adds that both Mauna Loa and Kilauea are now in great and increasing activity. These volcanoes are about 190 miles distant from Honolulu in a direct line, where their severest convulsions are only slightly felt, although once in many years their smoke slightly obscures the atmosphere at Honolulu. Kilauea is 25 miles east of Mauna Loa, and about 4000 feet high, while the latter is 14,000.

Is it not plausible that the oceanic wave reaching the northern coasts of the Hawaiian Islands originated in some slight disturbance at the bottom of the ocean near these islands, rather than in some greater disturbance on the Aleutian or Alaskan coasts?

## LOWEST TEMPERATURE AT FRANKLINVILLE, N. Y.

Dr. John W. Kales, Voluntary Observer at Franklinville, N. Y., reports that on the morning of January 5 his thermometers and thermograph registered —34° at 6 a. m., being the lowest ever recorded at that station.

## METEOR AT MARION, IND.

Mr. William T. Blythe, Section Director, Indianapolis, Ind., suggests that we put on record an observation of the great meteor, the largest and most brilliant ever witnessed in the neighborhood of Marion, Ind. It was seen on the morning of November 6, 1903, at exactly 20 minutes after 5 (we assume that this means 5 hours and 20 minutes central time, or 6 hours and 20 minutes Washington time, but we are not in-

formed as to whether central time is always used at Marion). The meteor is said to have been—

Coming toward the earth at an angle of 45°, and shortly after it passed over Marion an explosion was heard like that of the heavy discharge of nitroglycerin. The brightness was sufficient to turn night into day. The light of the moon was smothered in the light given out by the great ball of fire as it passed overhead from north to south. The ball was a dark red, like burning coal, and followed by a flaming tail. It was also accompanied by three other flames of fire. The explosion was heard as far as Jonesboro, Hartford City, Montpelier, and Upland.

## THE PECULIARITIES OF CALIFORNIA NORTHERS.

Prof. Alexander G. McAdie makes the following remarks in a letter to the Editor dated August 7, 1903:

I have read with the greatest interest the translation by Dr. Cleveland Abbe, jr., of a lecture delivered by Professor Ebert on "Atmospheric electricity considered from the standpoint of the theory of electrons." (See MONTHLY WEATHER REVIEW, May, 1903, p. 229.) What particularly interests us in California is the reference to the distribution of electrons in the air of the Foehn. We have what is generally known as a "norther" in California—one of the most distressing features of our climate. It is a common saying that no wise man will enter into a discussion when the north winds blows. It is a very dry wind and irritating to a high degree. It has always been supposed that these north winds were highly electrified, and one might well believe so, as there must be great friction in the rapid rushing of the abnormally dry air from the mountain ridges down into the valleys.

I wish that the problem might be taken up, either at Stanford or at Berkeley University, but I fear there will not be any considerable amount available for the prosecution of such experiments. There is no land under the sun where climate is so much talked about as it is in California, and where, from a purely commercial standpoint, climate is capital.

## OUR CLIMATOLOGICAL PUBLICATIONS.

The monthly reports and annual summaries published by the respective Climate and Crop sections contain a mass of valuable climatological data that is highly appreciated by those who have occasion to study the prominent features of the climate of the United States. Besides giving monthly means and extremes of temperature, rainfall, clear days, and prevailing winds, we have also in many cases full statements of snow, frosts, floods, and in perhaps every case a detailed account of the relation between the weather and the crop of the current year. In general, the maximum and minimum temperatures and the monthly and annual mean temperatures and total rainfalls, as also the departures from normal, are given for every station in an annual summary; analogous data for every day are given in the respective monthly reports. An average of 108 or 116 quarto pages is thus published annually by each of the 45 sections, and the sum total of 5000 pages yearly is a magnificient contribution to the study of climatology, the importance of which will be appreciated more fully by future generations.

Although these publications issue in large numbers from month to month, still they are only in pamphlet form, and it is extremely difficult to obtain a complete set for the whole of the United States. Such sets will always be highly prized by public libraries to which engineers, physicians, statisticians, and others must resort for consultation. We can, therefore, not refrain from urging that each section director see to it that sets of his own publications are preserved in the great State libraries and famous public libraries of the country. Certainly every section should have on its list of recipients such libraries as the Boston Public, the New York Public, the Philadelphia Public, the Library of Congress, the Meteorological libraries of Johns Hopkins, Chicago, Berkeley, Leland Stanford, Cornell, Yale, and Harvard universities; the library of the meteorological observatories at Blue Hill, Mass., and Central Park, New York City.

As back numbers, and especially complete sets of back numbers, of these monthly section reports are rare and much to be desired, we can but urge those voluntary observers who receive the reports to carefully preserve them, and see that eventually they are deposited where they will be permanently cared for and frequently used.



## WEATHER BUREAU MEN AS INSTRUCTORS.

Mr. David Cuthbertson, Local Forecaster, Buffalo, N. Y., reports that during January four classes in physical geography from the high schools of Buffalo and neighboring cities visited the office and received instruction from his assistants, Mr. W. J. A. Schoppe and Mr. F. T. Williams, in the construction and use of the station instruments, the preparation of weather maps and forecasts, as well as the general workings and benefits of the Bureau. In each case the instruction was varied to suit the needs of the class.

Mr. J. Warren Smith, Section Director, Columbus, Ohio, delivered an illustrated lecture upon the work of the Weather Bureau before the Central Ohio Farmers' Institute, Westerville, Ohio, January 30, 1904.

During the month of January two classes in physical geography from the city high schools, accompanied by their teachers, visited the office, and listened to a brief lecture on the instruments at the station and the work of the office.

Mr. H. C. Bate, Local Forecaster, Nashville, Tenn., states that the weather map and the art of forecasting are studied daily in the public schools and high schools of that city. Several private schools also take up the subject, and the students from these schools as well as from the Nashville University frequently visit the office of the Weather Bureau.

Mr. Robert Q. Grant, Observer, La Crosse, Wis., recently entertained the Nineteenth Century Club of that city at the office of the Weather Bureau, and gave an exposition of the theoretical and practical branches of meteorology.

Mr. J. R. Weeks, Observer, Macon, Ga., delivered during January a series of lectures for the benefit of the Macon Hospital.

Mr. W. M. Wilson, Section Director, Milwaukee, Wis., lectured on the Weather Bureau and its methods on January 16, in the Y. M. C. A. Hall of that city.

Mr. S. W. Glenn, Local Forecaster and Section Director, Huron, S. Dak., states that the teachers of the class in physics of the Huron High School have given special attention to meteorology. On January 22 and 27 the class visited the office of the Weather Bureau, inspected the instruments and listened to an hour's talk by Mr. Glenn.

Mr. P. H. Smyth, Observer, Cairo, Ill., has promised to address the Illinois State Convention of County Officials at Cairo, February 9, on the value of the Weather Bureau to commerce, agriculture, and navigation.

The class in physical geography at Hunter, Okla., maintains a weather record, and is studying the daily weather maps.

## HURRICANE OF AUGUST 14-15.

In the MONTHLY WEATHER REVIEW for September, 1903, p. 415, is given the record of the hurricane of August 14–15, as reported by Capt. J. Elligers, jr. At that time, the exact loca-

tion of the vessel could not be given, but has lately been obtained by Mr. W. C. Devereaux, Assistant Observer at Havana, Cuba, and the record is here published as given by the captain of the *Jason*.

| Date. | Hour. | Latitude, north. | | Longitude, west. | |
|---|---|---|---|---|---|
| | | ° | ′ | ° | ′ |
| August 14 | 4 a. m. | 22 | 29 | 95 | 43 |
| 14 | 8 a. m. | 22 | 33 | 95 | 18 |
| 14 | 12 noon | 22 | 35 | 95 | 5 |
| 14 | 4 p. m. | 22 | 35 | 94 | 59 |
| 14 | 8 p. m. | 22 | 36 | 94 | 52.5 |
| 14 | 9 p. m. | 22 | 36 | 94 | 51 |
| 14 | 10 p. m. | 22 | 41 | 94 | 47 |
| 14 | 12 midn't | 22 | 49 | 94 | 42 |
| 15 | 4 a. m. | 23 | 0 | 94 | 34 |
| 15 | 8 a. m. | 23 | 4 | 94 | 25 |
| 15 | 12 noon | 23 | 7 | 94 | 19 |

## CONDITION OF THE OCEAN.

An agreement has been entered into between the United States Weather Bureau, the United States Hydrographic Office, and the Director of the Meteorological Service of the Azores, Capt. François S. Chaves, in accordance with which all reports as to the condition of the ocean, all local meteorological data, and all information regarding derelicts, wrecks, and icebergs will be cabled immediately to the Weather Bureau, for which purpose the ocean cable service between Horta and New York is free up to a limit of thirty words daily. Copies of all such reports will be transmitted immediately by the Weather Bureau to the Hydrographic Office and to all other interested parties.

## PATHS OF STORM CENTERS.

A recent number of the Register and Leader, Des Moines, Iowa, January 24, contains an article by Mr. H. A. Campbell, of that city, elucidating the general principle that storm centers or centers of low pressure move in quite regular paths across the American Continent, and that these paths are located farther north or south from time to time. A given region, such as Iowa, may for months together lie entirely south of the paths, and therefore enjoy mostly clear, pleasant, or dry weather; while at other times the paths of the storms pass over the region in rapid succession, and give it a long rainy season.

After the long drought of 1901 the belt embracing the paths of the lows moved farther to the south. After June 10, 1902, this belt was about 1200 miles wide, and 60 lows were recorded in it between June 11 and September 1, while only two were south of the Great Lakes and entirely out of the belt.

From September 18, 1903, to January 14, 1904, Mr. Campbell finds the great majority of storms confined within this same general belt. When storms move from west to east within this belt, only light rains, or perhaps entire droughts, occur in Iowa or other States south of the line from New York, N.Y., to Victoria, Vancouvers Island.

During the summer of 1894 an unprecedented drought prevailed in Iowa, while the belt within which the storm paths occurred lay far to the north, stretching from east to west across British America. There were many storm paths in that region, but none far enough south to bring rain to Iowa.

All modern weather bureaus base their forecasts on the daily weather map, and all monthly weather reviews or annual summaries show the paths that storm centers have pursued as they moved over the surface of the globe. As far back as 1872 it was the custom in the Weather Bureau for the forecaster who went off duty at the close of any month to explain to the one who relieved him that recent maps had shown that the general movement of the centers of low pressure was faster or slower and farther north or farther south, as the case might be, so that the incoming official could make a proper allowance for this variation in his daily forecasts. In the MONTHLY WEATHER REVIEW, beginning with January, 1873, it began to be the custom to call attention to the fact that the average latitude of the paths of low pressure had, during a given month, been somewhat to the north or south, east or west of their usual position. In a general chart showing the average frequency of storm tracks, compiled by the Editor for the statistical atlas of the Census Bureau in 1874, it was shown that the belt of greatest frequency seemed to pass centrally over our Lake region, and thence eastward to Newfoundland. Finally, in 1893, in Weather Bureau Bulletin A, or "Summary of International Meteorological Observations," there are given charts compiled by Professor Garriott showing the average and principal storm tracks and storm frequency, month by month, over the whole Northern Hemisphere. The belt of greatest storm frequency extends from near Sitka southeastward to Duluth, thence eastward to St. Johns, Newfoundland.

This belt may be said to begin in the Philippines. It extends east-northeast over Japan and the Aleutian Islands before reaching Sitka. It also extends from New Foundland eastward to the mid-Atlantic, after which it branches southeastward to France and Turkey, and northeastward to Norway, Sweden, northern Russia, and Siberia, where it seems to be lost. Possibly more perfect weather charts of central Asia would enable us to trace this belt around the globe, but there is some reason for believing that it really does come to an end, and that general storms are infrequent in northern China and Siberia, although local rains must occur. The average movement of storms along this great belt is variable; many of them of course die out entirely, but others soon take their place. During the ten years, 1878–1887, for which Mr. Garriott's charts hold good, the velocity of progress of the strom centers within this belt of greatest frequency varied from seven miles an hour in one portion of the belt during the month of April, to thirty-seven miles an hour in another portion in January and February. The average eastward velocity for all storms and portions of the belt was 22 miles per hour, but the average within the United States was 30 miles per hour; over the North Atlantic Ocean, 20 miles; over Europe, 18 miles; over Japan, 23 miles; over Bering Sea and the Aleutian Islands 20 miles; along the coast of Alaska, 18 miles.

All storms that begin in the northern trade wind region move westward and slowly northward, until they have entered the region of westerly winds, latitude 25° or 30°, after which they move northeastward until they enter the belt of greatest storm frequency. The average motion westward during the first part of their course is 23 miles per hour; the average motion eastward is about twenty-two miles per hour, according to Professor Garriott's tables.

The path of greatest storm frequency seems to coincide with the average dividing line or boundary between regions of cold northerly and warm southerly winds. It also coincides nearly with the trend of the isobars at 3 miles above the earth's surface, but the speed of movement of the storm center has nothing to do with the speed of the lower wind as it blows around that center. It may possibly have some connection with the general speed of the upper currents of air, as they blow around the polar region in connection with the isobars at the 3-mile or some other upper level. It may, therefore, be approximately true that the upper air blows eastward with an average velocity over the North American portion of this belt of 30 miles per hour throughout the year. This may be equivalent to saying that in the latitude of 50° north the layer of air that determines the movement of the storm centers, provided we think of them as drifting along with that layer, must be moving at such a rate that it passes from longitude 140° west eastward to longitude 50° west, that is to say, one quarter of the way around this small circle of latitude in about five and one-half days.

At latitude 50°, one degree of the small circle of latitude is 44.552 statute miles. Therefore, 90°, or one-quarter of the circle, is 4009.7 miles. At the rate of 30 miles per hour, this would be described in 133.7 hours, or five days and fourteen hours, and the whole circle would be described in twenty-two days and eight hours. On the other hand, if the storm centers are supposed to follow the wind and the isobars at about 3 miles above the earth's surface, as shown in the MONTHLY WEATHER REVIEW for November, 1896, Chart VII, or in Professor Bigelow's Report on International Cloud Observations, charts 40 and 43, then, owing to the oval form of these isobars, the track may be somewhat shorter than the small circle, and the time of describing the oval may be seventeen days. In general the daily weather predictions depend upon evidence as to what the storm center's path will be. Sometimes we can look ahead several days and see that storms will pass far to north or south, but the rules governing their average paths are not yet worked out satisfactorily.

## THE WEATHER OF THE MONTH.

By Mr. W. B. STOCKMAN, District Forecaster, in charge of Division of Meteorological Records.

### PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart VIII and the average values and departures from normal are shown in Tables I and VI.

The mean monthly barometric pressure was high over the Rocky Mountain and Pacific districts, northern Missouri Valley and North Dakota, with the crest over portions of the middle and northern Plateau regions, the maximum mean pressure for the month being 30.30 inches at Boise, Idaho. The mean pressure was low over southern Florida, northern New England, and the northeastern portion of the upper Lake region. The minimum mean pressure was 30.02 inches at Eastport, Me.

The mean pressure was above the normal from Mexico and the western portion of the coast of Texas northward and northwestward to the Canadian boundary of Idaho and Washington, and westward to the Pacific Ocean; also in North Dakota, the upper Lake region, New England, Middle Atlantic States, and northern portion of the South Atlantic States; in all other districts it was below normal. The greatest excess of pressure ranged from +0.15 inch to +0.19 inch, and occurred in the north and middle Pacific districts. The greatest deficiency in pressure ranged from −0.06 inch to −0.08 inch, and occurred in Montana.

The mean pressure increased over that for December, 1903, in the Pacific districts south of Washington, in southwestern Arizona, northern part of the South Atlantic States, Middle Atlantic States, New England, Lake region, northern portions of the upper Mississippi and Missouri valleys, and North Dakota; elsewhere the mean pressure showed a decrease.

The greatest increase in pressure occurred over New England, northern portion of the Middle Atlantic States, eastern lower Lake region, and northern upper Lake region. The greatest decrease was reported from the northern and middle slope and Plateau regions.

### TEMPERATURE OF THE AIR.

The distribution of maximum, minimum, and average surface temperatures is graphically shown by the lines on Chart V.

By geographic districts the temperature was above normal in the west Gulf States, Missouri Valley, and the northern and middle slope, northern Plateau and Pacific regions, and below normal in the remaining districts. The plus departures were very marked in the northern slope and northern Plateau regions, as were the minus departures in the Atlantic States and Lake region.

East of the Mississippi River the departures generally averaged from −4.0° to −8.7° per day, the greatest daily deficiency occurring over the mountain districts of New York and Pennsylvania. Over the northern Plateau, northern slope, and northern portions of the middle slope and middle Plateau regions the mean daily departures ranged from +4.0° to +12.3°, the departure increasing from the southern portion of the area northwestward, the maximum departures occurring over north-central Montana.

The isotherms of 60° and 50° of mean temperature did not differ much from their location in January, 1903; 40° and 30° lay somewhat to the southward; east of the Mississippi 20° and 10° lay considerably to the southward; and an isotherm of zero mean temperature, of which there was none in January, 1903, included northern Minnesota, and northeastern North Dakota.

The isotherms of maximum and minimum temperature over the eastern half of the country, as a rule, lay well to the southward of their location in January, 1903.

The average temperatures for the several geographic districts and the departures from the normal values are shown in the following table:

*Average temperatures and departures from normal.*

| Districts. | Number of stations. | Average temperatures for the current month. | Departures for the current month. | Accumulated departures since January 1. | Average departures since January 1. |
|---|---|---|---|---|---|
| | | ° | ° | ° | ° |
| New England | 8 | 19.0 | − 6.0 | ........ | ........ |
| Middle Atlantic | 12 | 26.1 | − 6.1 | ........ | ........ |
| South Atlantic | 10 | 41.4 | − 4.7 | ........ | ........ |
| Florida Peninsula* | 8 | 57.7 | − 2.0 | ........ | ........ |
| East Gulf | 9 | 45.4 | − 3.0 | ........ | ........ |
| West Gulf | 7 | 47.1 | + 0.5 | ........ | ........ |
| Ohio Valley and Tennessee | 11 | 30.4 | − 3.9 | ........ | ........ |
| Lower Lake | 8 | 18.6 | − 6.7 | ........ | ........ |
| Upper Lake | 10 | 12.2 | − 5.3 | ........ | ........ |
| North Dakota* | 8 | 4.3 | − 1.0 | ........ | ........ |
| Upper Mississippi Valley | 11 | 17.5 | − 3.6 | ........ | ........ |
| Missouri Valley | 11 | 20.9 | + 1.0 | ........ | ........ |
| Northern Slope | 7 | 24.0 | + 6.5 | ........ | ........ |
| Middle Slope | 6 | 30.9 | + 1.9 | ........ | ........ |
| Southern Slope* | 6 | 38.2 | − 0.7 | ........ | ........ |
| Southern Plateau* | 13 | 36.8 | − 0.1 | ........ | ........ |
| Middle Plateau* | 8 | 24.6 | − 1.4 | ........ | ........ |
| Northern Plateau* | 12 | 31.0 | + 5.6 | ........ | ........ |
| North Pacific | 7 | 41.6 | + 2.4 | ........ | ........ |
| Middle Pacific | 5 | 48.0 | + 1.0 | ........ | ........ |
| South Pacific | 4 | 52.2 | + 1.6 | ........ | ........ |

* Regular Weather Bureau and selected voluntary stations.

*In Canada.*—Prof. R. F. Stupart says:

The temperature was below the average from the western portion of Lake Superior to the Maritime Provinces and very much below in many localities, especially in the Georgian Bay district, the lower Lake region and the Ottawa and upper St. Lawrence valleys, where the negative departures ranged from 5° to 12°. In the Maritime Provinces the departure was from 3° to 5°, and in Quebec from 1° to 5°. British Columbia was generally just the average, while from the Rocky Mountains east to Lake Superior the temperature was everywhere above the average, Manitoba giving a positive departure of 3° to 4°, and the Territories from 3° to 9°, the maxima positive departures occurring in Alberta and southwestern Assiniboia.

### PRECIPITATION.

The distribution of total monthly precipitation is shown on Chart III.

The precipitation was normal in the upper Mississippi Valley, and southern slope region; above normal in the Florida Peninsula, and lower Lake region; and below normal in the remaining geographic districts. The most marked departures occurred in the Florida Peninsula, west Gulf States, and the middle and south Pacific districts.

Over central and northern Florida the excess ranged from 2.0 to 4.0 inches, the greatest occurring on the west-central

coast. Deficiencies of 2.0 to 3.8 inches occurred over the Appalachian regions of the Virginias and the Carolinas, the west Gulf States, northern Arizona, and the middle and south Pacific districts. The heaviest precipitation occurred in the north Pacific region, while the precipitation, as a rule, was light from the Pacific district eastward to the Mississippi.

Snow occurred except in the southern portions of the South Atlantic and Gulf States, western Arizona, and southern and western California. At the end of the month snow lay on the ground as far south as the center of the South Atlantic States, northern portion of the east Gulf States, southern portion of the Missouri Valley, and the northern part of the southern slope and central portion of the middle Plateau regions, and as far west as north-central and eastern Oregon, and eastern Washington. Snow on ground was also observed in portions of New Mexico, Arizona, and northeastern California.

Snow occurred far to the southward, and the limit of snow on ground lay much to the southward of January, 1903.

*Average precipitation and departure from the normal.*

| Districts. | Number of stations. | Average. | | Departure. | |
|---|---|---|---|---|---|
| | | Current month. | Percentage of normal. | Current month. | Accumulated since Jan. 1. |
| | | *Inches.* | | *Inches.* | *Inches.* |
| New England | 8 | 3.64 | 92 | −0.3 | .......... |
| Middle Atlantic | 12 | 2.60 | 79 | −0.7 | .......... |
| South Atlantic | 10 | 3.32 | 83 | −0.7 | .......... |
| Florida Peninsula * | 8 | 5.41 | 193 | +2.6 | .......... |
| East Gulf | 9 | 3.71 | 51 | −1.6 | .......... |
| West Gulf | 7 | 1.40 | 40 | −2.1 | .......... |
| Ohio Valley and Tennessee | 11 | 2.65 | 62 | −1.6 | .......... |
| Lower Lake | 8 | 4.12 | 157 | +1.5 | .......... |
| Upper Lake | 10 | 1.19 | 60 | −0.8 | .......... |
| North Dakota * | 8 | 0.45 | 69 | −0.1 | .......... |
| Upper Mississippi Valley | 11 | 1.80 | 100 | 0.0 | .......... |
| Missouri Valley | 11 | 0.90 | 90 | −0.1 | .......... |
| Northern Slope | 7 | 0.38 | 66 | −0.2 | .......... |
| Middle Slope | 6 | 0.50 | 71 | −0.2 | .......... |
| Southern Slope * | 6 | 0.89 | 100 | 0.0 | .......... |
| Southern Plateau * | 13 | 0.21 | 19 | −0.9 | .......... |
| Middle Plateau * | 8 | 1.01 | 77 | −0.3 | .......... |
| Northern Plateau * | 12 | 1.06 | 54 | −0.9 | .......... |
| North Pacific | 7 | 6.17 | 83 | −1.3 | .......... |
| Middle Pacific | 5 | 1.78 | 33 | −3.6 | .......... |
| South Pacific | 4 | 0.46 | 17 | −2.3 | .......... |

* Regular Weather Bureau and selected voluntary stations.

*In Canada.*—Professor Stupart says:

The precipitation was above the average over British Columbia, except in parts of Vancouver Island, the positive departures being pronounced at the interior stations. In the Territories, Manitoba, and Nova Scotia the average was also locally exceeded. The southwestern counties of Ontario likewise recorded a positive departure, but elsewhere in Canada the precipitation was not equal to the average amount, the negative departures ranging from a few tenths of an inch to an inch and a half. The snowfall in many portions of Ontario exceeded the usual quantity, also in some sections of the Maritime Provinces, but the rainfall, especially in the former province, was much below the average amount.

### HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 4, 11, 13, 16. Arizona, 7. Arkansas, 22. California, 17, 18, 19. Connecticut, 13, 22. Idaho, 14. Illinois, 10. Indiana, 22. Iowa, 8. Kentucky, 11. Louisiana, 22. Mississippi, 16, 19, 21, 22. Missouri, 9. Montana, 11. New Jersey, 12. New York, 2, 13, 22, 24, 26. Oregon, 4, 5, 8, 10, 16, 17, 18, 19, 25. Pennsylvania, 2, 20, 21. South Carolina, 11, 26, 28. Tennessee, 2, 11, 22. Texas, 21, 22, 26, 28, 30. Utah, 10, 11, 18. Vermont, 22. Washington, 2, 4, 8, 9, 10, 23, 24. West Virginia, 2.

### SLEET.

The following are the dates on which sleet fell in the respective States:

Alabama, 13, 27, 28, 29, 31. Arizona, 19, 20. Arkansas, 21, 22, 25, 26, 31. California, 17, 18, 19. Colorado, 9, 30. Connecticut, 13, 20, 21, 22, 23, 26. Delaware, 3, 11, 12, 13. District of Columbia, 2, 26. Florida, 28. Georgia, 4, 6, 7, 13, 26, 28, 31. Idaho, 4, 9, 22, 24. Illinois, 1, 2, 9, 10, 11, 19, 22, 25. Indiana, 1, 2, 10, 11, 21, 22, 25. Indian Territory, 21, 22, 25. Iowa, 3, 8, 9, 10, 18, 19, 20, 21, 22. Kansas, 1, 9, 12, 20, 21, 25, 26, 29, 30, 31. Kentucky, 2, 6, 7, 10, 11, 13, 22, 25, 26, 31. Louisiana, 27, 28. Maine, 22, 23, 24, 31. Maryland, 2, 3, 4, 10, 11, 12, 13, 16, 20, 26. Massachusetts, 12, 13, 16, 22, 23, 26, 27. Michigan, 20, 21, 22. Minnesota, 7. Mississippi, 13, 21, 26, 27, 28, 30, 31. Missouri, 1, 2, 9, 10, 12, 20, 21, 22, 25, 26, 30, 31. Montana, 28, 30. Nebraska, 4, 9, 10, 15, 16, 19, 20, 23, 29, 30. Nevada, 4, 5, 17, 18. New Hampshire, 13, 22, 23. New Jersey, 2, 3, 11, 12, 13, 16, 20, 21, 22, 26. New Mexico, 7. New York, 8, 9, 13, 19, 20, 21, 22, 23, 24, 26. North Carolina, 4, 7, 11, 13, 26, 28, 29, 30, 31. North Dakota, 29. Ohio, 1, 2, 3, 7, 8, 10, 11, 12, 13, 19, 22, 26. Oklahoma, 14, 21. Oregon, 1, 2, 14, 18, 20. Pennsylvania, 2, 13, 16, 20, 21. Rhode Island, 20, 22. South Carolina, 4, 6, 7, 8, 28, 29. South Dakota, 1, 9. Tennessee, 6, 7, 16, 22, 24, 25, 26, 31. Texas, 21, 27. Utah, 10. Vermont, 13, 14, 22. Virginia, 2, 3, 10, 11, 13, 16, 26, 28, 29. Washington, 1, 2, 9, 12, 16. West Virginia, 1, 2, 3, 10, 11, 12, 16, 20, 25. Wisconsin, 20, 21, 22.

## HUMIDITY.

The relative humidity was normal in the Ohio Valley and Tennessee and the upper Lake region; above normal in New England, the Florida Peninsula, lower Lake region, upper Mississippi and Missouri valleys, and the northern slope and north Pacific regions; and below normal in the remaining districts, markedly so in the Gulf States, southern slope and southern Plateau regions, and the middle and south Pacific districts

The averages by districts appear in the subjoined table:

*Average relative humidity and departures from the normal.*

| Districts. | Average. | Departure from the normal. | Districts. | Average. | Departure from the normal. |
|---|---|---|---|---|---|
| | % | | | % | |
| New England | 79 | + 3 | Missouri Valley | 77 | + 2 |
| Middle Atlantic | 74 | − 2 | Northern Slope | 76 | + 6 |
| South Atlantic | 74 | − 3 | Middle Slope | 65 | − 2 |
| Florida Peninsula | 83 | + 2 | Southern Slope | 57 | − 9 |
| East Gulf | 70 | − 7 | Southern Plateau | 42 | − 8 |
| West Gulf | 67 | − 9 | Middle Plateau | 68 | − 2 |
| Ohio Valley and Tennessee | 77 | 0 | Northern Plateau | 78 | − 2 |
| Lower Lake | 83 | + 2 | North Pacific | 87 | + 2 |
| Upper Lake | 83 | 0 | Middle Pacific | 74 | − 7 |
| North Dakota | 76 | − 4 | South Pacific | 59 | −13 |
| Upper Mississippi Valley | 80 | + 2 | | | |

## SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart IV, and the numerical values of average daylight cloudiness, both for individual stations and by geographic districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the following table:

*Average cloudiness and departures from the normal.*

| Districts. | Average. | Departure from the normal. | Districts. | Average. | Departure from the normal. |
|---|---|---|---|---|---|
| New England | 6.0 | + 0.2 | Missouri Valley | 5.4 | + 0.3 |
| Middle Atlantic | 5.8 | + 0.2 | Northern Slope | 5.8 | + 1.2 |
| South Atlantic | 5.2 | − 0.1 | Middle Slope | 4.0 | + 0.2 |
| Florida Peninsula | 5.2 | + 0.5 | Southern Slope | 3.2 | − 0.6 |
| East Gulf | 5.3 | − 0.3 | Southern Plateau | 1.8 | − 1.1 |
| West Gulf | 4.1 | − 1.3 | Middle Plateau | 3.9 | − 0.9 |
| Ohio Valley and Tennessee | 6.2 | − 0.2 | Northern Plateau | 6.9 | − 0.4 |
| Lower Lake | 7.5 | 0.0 | North Pacific | 8.5 | + 1.4 |
| Upper Lake | 6.7 | − 0.1 | Middle Pacific | 3.7 | − 1.4 |
| North Dakota | 5.3 | + 0.6 | South Pacific | 2.4 | − 1.7 |
| Upper Mississippi Valley | 5.3 | 0.0 | | | |

The cloudiness was normal in the lower Lake region, and upper Mississippi Valley; above the average in New England, Middle Atlantic States, Florida Peninsula, North Dakota, Missouri Valley, and the northern and middle slope and north Pacific regions. In the remaining geographic districts the cloudiness was below the average.

## ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

*Thunderstorms.*—Reports of 427 thunderstorms were received during the current month as against 372 in 1903 and 164 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 22d, 90; 21st, 79; 20th, 48.

Reports were most numerous from: Florida and Texas, 39; Missouri, 35; South Carolina and Tennessee, 28.

*Auroras.*—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: December 30 to January 7.

*In Canada:* Thunderstorms were reported from Toronto, 22, and Hamilton, Bermuda, 14.

Auroras were reported from Father Point, 15; Minnedosa, 11, 16, 28; Edmonton, 10, 11, 12; Prince Albert, 10, 11, 25; Battleford, 11, 12, 23.

## WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

*Maximum wind velocities.*

| Stations. | Date. | Velocity. | Direction. | Stations. | Date. | Velocity. | Direction. |
|---|---|---|---|---|---|---|---|
| Birmingham, Ala | 22 | 50 | se. | New York, N. Y | 17 | 54 | nw. |
| Block Island, R. I | 2 | 52 | n. | North Head, Wash | 3 | 58 | se. |
| Do | 3 | 56 | n. | Do | 4 | 54 | nw. |
| Do | 4 | 66 | nw. | Do | 8 | 59 | s. |
| Do | 15 | 54 | w. | Do | 9 | 78 | se. |
| Do | 17 | 53 | nw. | Do | 11 | 60 | se. |
| Do | 25 | 56 | w. | Do | 13 | 54 | s. |
| Do | 26 | 54 | s. | Do | 15 | 74 | se. |
| Buffalo, N. Y | 22 | 53 | w. | Do | 16 | 58 | s. |
| Do | 24 | 58 | w. | Do | 17 | 58 | s. |
| Do | 26 | 54 | w. | Do | 20 | 54 | se. |
| Cape Henry, Va | 3 | 68 | nw. | Point Reyes Light, Cal | 4 | 62 | nw. |
| Carson City, Nev | 10 | 52 | w. | Do | 5 | 58 | nw. |
| Cheyenne, Wyo | 18 | 50 | w. | Do | 8 | 59 | nw. |
| Chicago, Ill | 2 | 54 | ne. | Do | 9 | 57 | nw. |
| Do | 18 | 51 | se. | Do | 17 | 56 | nw. |
| Cleveland, Ohio | 2 | 56 | ne. | Do | 18 | 57 | nw. |
| Columbus, Ohio | 22 | 61 | sw. | Do | 19 | 50 | nw. |
| Hatteras, N. C | 3 | 52 | n. | Do | 21 | 53 | nw. |
| Do | 29 | 50 | n. | Sioux City, Iowa | 18 | 50 | se. |
| Minneapolis, Minn | 18 | 50 | se. | Tatoosh Island, Wash | 7 | 60 | s. |
| Modena, Utah | 18 | 55 | sw. | Do | 8 | 70 | w. |
| Mount Tamalpais, Cal | 8 | 70 | nw. | Do | 12 | 71 | s. |
| Do | 9 | 59 | nw. | Do | 13 | 56 | sw. |
| Nantucket, Mass | 3 | 60 | n. | Do | 16 | 70 | sw. |
| New York, N. Y | 15 | 53 | nw. | Do | 23 | 50 | nw. |

## DESCRIPTION OF TABLES AND CHARTS.

By Mr. W. B. STOCKMAN, District Forecaster, in charge of Division of Meteorological Records.

For description of tables and charts see page 603 of REVIEW for December, 1903.

TABLE I.—*Climatological data for Weather Bureau stations, January, 1904.*

| Stations. | Elevation of instruments. Barometer above sea level, feet. | Thermometers above ground. | Anemometer above ground. | Pressure, in inches. Actual, reduced to mean of 24 hours. | Sea level, reduced to mean of 24 hrs. | Departure from normal. | Temperature of the air, in degrees Fahrenheit. Mean max. + mean min. ÷ 2. | Departure from normal. | Maximum. | Date. | Mean maximum. | Minimum. | Date. | Mean minimum. | Greatest daily range. | Mean wet thermometer. | Mean temperature of the dew-point. | Mean relative humidity, per cent. | Precipitation, in inches. Total. | Departure from normal. | Days with .01, or more. | Wind. Total movement, miles. | Prevailing direction. | Maximum velocity. Miles per hour. | Direction. | Date. | Clear days. | Partly cloudy days. | Cloudy days. | Average cloudiness, tenths. | Total snowfall. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *New England.* | | | | | | | 19.0 | − 6.0 | | | | | | | | | | 79 | 3.64 | − 0.3 | | | | | | | | | | 6.0 | |
| Eastport | 76 | 69 | 82 | 29.93 | 30.02 | − .02 | 15.0 | − 5.4 | 42 | 14 | 22 | −14 | 4 | 8 | 33 | 14 | 11 | 86 | 3.04 | − 0.9 | 15 | 11,818 | nw. | 46 | ne. | 9 | 9 | 5 | 17 | 6.5 | 22.3 |
| Portland, Me. | 103 | 81 | 117 | 29.93 | 30.06 | + .01 | 15.6 | − 6.9 | 42 | 14 | 24 | −10 | 4 | 8 | 28 | 14 | 10 | 81 | 4.04 | + 0.4 | 14 | 7,491 | nw. | 32 | nw. | 3 | 11 | 7 | 13 | 5.6 | 31.3 |
| Concord | 298 | 70 | 79 | 29.72 | 30.07 | + .02 | 13.4 | − 7.6 | 38 | 14 | 23 | −23 | 4 | 4 | 40 | ... | ... | ... | 3.69 | + 0.4 | 14 | 4,221 | nw. | 26 | ne. | 13 | 10 | 5 | 16 | 6.1 | 27.1 |
| Northfield | 876 | 16 | 60 | 29.08 | 30.09 | + .04 | 7.6 | − 7.9 | 35 | 23 | 18 | −32 | 19 | − 3 | 40 | 6 | 2 | 78 | 2.38 | − 0.4 | 16 | 5,601 | s. | 38 | nw. | 1 | 3 | 9 | 19 | 7.6 | 27.0 |
| Boston | 125 | 115 | 181 | 29.92 | 30.06 | + .01 | 21.6 | − 5.4 | 46 | 13 | 29 | − 6 | 19 | 14 | 27 | 20 | 15 | 77 | 4.80 | + 0.7 | 16 | 8,583 | w. | 37 | nw. | 17 | 12 | 6 | 13 | 5.3 | 35.7 |
| Nantucket | 12 | 43 | 82 | 30.02 | 30.04 | .00 | 28.1 | − 3.3 | 50 | 23 | 34 | 2 | 4 | 22 | 30 | 26 | 22 | 80 | 5.98 | + 2.2 | 16 | 11,849 | nw. | 60 | n. | 3 | 5 | 10 | 16 | 7.0 | 39.5 |
| Block Island | 26 | 11 | 46 | 30.03 | 30.06 | − .01 | 26.2 | − 4.9 | 50 | 23 | 32 | 0 | 4 | 20 | 29 | 24 | 20 | 79 | 2.54 | − 1.7 | 16 | 16,445 | nw. | 66 | nw. | 4 | 12 | 10 | 9 | 5.3 | 13.7 |
| Narragansett | ... | 9 | 38 | ... | ... | | 23.0 | − 5.8 | 63 | 1 | 32 | −10 | 5 | 14 | 48 | ... | ... | ... | 3.40 | − 1.8 | 16 | ... | w. | ... | ... | ... | 16 | 3 | 12 | ... | 21.5 |
| New Haven | 106 | 117 | 140 | 29.96 | 30.08 | .00 | 20.8 | − 6.7 | 50 | 22 | 28 | − 6 | 5 | 13 | 32 | 18 | 13 | 72 | 2.78 | − 1.5 | 14 | 7,628 | n. | 45 | ne. | 2 | 15 | 6 | 10 | 5.0 | 19.3 |
| *Mid. Atlantic States.* | | | | | | | 26.1 | − 6.1 | | | | | | | | | | 74 | 2.60 | − 0.7 | | | | | | | | | | 5.8 | |
| Albany | 97 | 102 | 115 | 30.00 | 30.12 | + .05 | 14.8 | − 8.4 | 48 | 22 | 24 | −24 | 5 | 6 | 35 | 13 | 10 | 80 | 2.51 | − 0.4 | 15 | 5,624 | nw. | 28 | n. | 3 | 8 | 7 | 16 | 6.6 | 20.8 |
| Binghamton | 875 | 79 | 90 | 29.12 | 30.10 | + .02 | 15.8 | − 6.6 | 54 | 22 | 25 | −26 | 19 | 7 | 39 | ... | ... | ... | 2.11 | − 0.8 | 18 | 5,170 | ne. | 30 | s. | 22 | 5 | 10 | 16 | 7.1 | 22.6 |
| New York | 314 | 108 | 350 | 29.72 | 30.08 | − .02 | 24.1 | − 6.4 | 55 | 23 | 30 | − 4 | 5 | 18 | 23 | 22 | 16 | 71 | 3.38 | − 0.7 | 12 | 11,522 | nw. | 54 | nw. | 17 | 14 | 3 | 14 | 5.1 | 15.2 |
| Harrisburg | 374 | 94 | 104 | 29.70 | 30.12 | + .02 | 21.6 | − 8.7 | 54 | 22 | 28 | − 5 | 5 | 15 | 23 | 19 | 15 | 79 | 3.11 | − 0.5 | 11 | 5,663 | nw. | 36 | w. | 24 | 11 | 6 | 14 | 5.9 | 19.5 |
| Philadelphia | 117 | 168 | 184 | 29.98 | 30.12 | + .01 | 26.0 | − 6.0 | 56 | 22 | 32 | − 2 | 5 | 20 | 23 | 23 | 18 | 73 | 3.14 | − 0.2 | 11 | 8,570 | nw. | 36 | nw. | 3 | 12 | 4 | 15 | 5.6 | 14.2 |
| Scranton | 805 | 111 | 119 | 29.20 | 30.11 | + .02 | 18.6 | ... | 56 | 22 | 27 | −15 | 19 | 10 | 28 | 17 | 12 | 75 | 3.23 | ... | 15 | 5,499 | sw. | 34 | sw. | 24 | 6 | 7 | 18 | 7.3 | 17.8 |
| Atlantic City | 52 | 39 | 48 | 30.05 | 30.11 | .00 | 27.2 | − 3.3 | 50 | 23 | 34 | − 2 | 5 | 21 | 26 | 25 | 21 | 79 | 2.13 | − 1.7 | 12 | 6,696 | nw. | 27 | s. | 23 | 11 | 10 | 10 | 5.6 | 9.8 |
| Cape May | 17 | 47 | 51 | 30.11 | 30.13 | + .01 | 27.8 | − 6.6 | 50 | 21 | 33 | 0 | 5 | 22 | 22 | ... | ... | ... | 2.13 | − 1.7 | 13 | 7,018 | nw. | 33 | nw. | 3 | 9 | 13 | 9 | 5.3 | 7.6 |
| Baltimore | 123 | 69 | 117 | 29.97 | 30.11 | − .01 | 27.4 | − 6.6 | 58 | 22 | 34 | 2 | 5 | 21 | 26 | 24 | 18 | 68 | 2.86 | − 0.5 | 13 | 5,664 | nw. | 34 | w. | 14 | 8 | 10 | 13 | 6.0 | 16.6 |
| Washington | 112 | 59 | 76 | 30.00 | 30.13 | .00 | 27.5 | − 5.7 | 62 | 22 | 35 | 3 | 19 | 20 | 31 | 24 | 19 | 72 | 2.62 | − 0.9 | 13 | 5,226 | nw. | 34 | nw. | 3 | 16 | 4 | 11 | 4.7 | 16.5 |
| Cape Henry | 18 | 11 | 58 | 30.08 | 30.10 | − .03 | 35.6 | − 4.6 | 69 | 22 | 43 | 15 | 19 | 28 | 43 | ... | ... | ... | 2.49 | + 1.8 | 9 | 11,039 | n. | 68 | nw. | 3 | 10 | 5 | 16 | 6.0 | 2.1 |
| Lynchburg | 681 | 83 | 88 | 29.33 | 30.10 | − .03 | 32.8 | − 4.0 | 63 | 21 | 42 | 8 | 30 | 24 | 36 | 28 | 22 | 69 | 1.47 | − 2.5 | 10 | 3,219 | nw. | 35 | nw. | 2 | 11 | 11 | 9 | 5.4 | 7.9 |
| Norfolk | 91 | 102 | 111 | 30.03 | 30.13 | − .03 | 36.4 | − 4.0 | 68 | 22 | 44 | 14 | 3 | 29 | 46 | 31 | 26 | 69 | 3.19 | − 0.6 | 10 | 7,284 | n. | 33 | sw. | 22 | 11 | 6 | 14 | 5.5 | 3.9 |
| Richmond | 144 | 82 | 90 | 29.98 | 30.14 | + .01 | 33.4 | ... | 68 | 22 | 42 | 9 | 19 | 25 | 37 | ... | ... | ... | 2.34 | ... | 12 | 4,475 | n. | 24 | sw. | 21 | 13 | 8 | 10 | 5.1 | 10.7 |
| Wytheville | 2,293 | 40 | 47 | 27.63 | 30.10 | − .04 | 28.8 | ... | 60 | 22 | 38 | 1 | 30 | 20 | 40 | 25 | 22 | 80 | 1.73 | ... | 10 | 4,631 | w. | 30 | nw. | 2 | 14 | 3 | 14 | 5.2 | 10.2 |
| *S. Atlantic States.* | | | | | | | 41.4 | − 4.7 | | | | | | | | | | 74 | 3.32 | − 0.7 | | | | | | | | | | 5.2 | |
| Asheville | 2,255 | 53 | 75 | 27.69 | 30.10 | − .05 | 32.8 | − 5.1 | 59 | 1 | 43 | 6 | 30 | 23 | 41 | 28 | 23 | 72 | 1.42 | − 1.6 | 7 | 6,923 | nw. | 40 | nw. | 2 | 8 | 13 | 10 | 5.6 | 6.8 |
| Charlotte | 773 | 68 | 76 | 29.27 | 30.13 | − .02 | 37.3 | − 3.9 | 63 | 22 | 45 | 14 | 5 | 29 | 27 | 32 | 25 | 66 | 1.38 | − 3.8 | 6 | 5,727 | sw. | 35 | sw. | 22 | 13 | 6 | 12 | 5.0 | 1.5 |
| Hatteras | 11 | 12 | 47 | 30.11 | 30.12 | − .02 | 40.4 | − 5.3 | 65 | 22 | 46 | 24 | 4 | 34 | 25 | 38 | 36 | 85 | 5.11 | − 0.8 | 10 | 12,611 | n. | 52 | n. | 3 | 12 | 8 | 11 | 5.4 | 1.2 |
| Raleigh | 376 | 71 | 79 | 29.72 | 30.14 | + .01 | 37.0 | − 3.8 | 70 | 22 | 46 | 13 | 6 | 28 | 36 | 32 | 27 | 74 | 2.80 | − 0.8 | 9 | 5,294 | ne. | 37 | nw. | 3 | 16 | 4 | 11 | 4.3 | 1.6 |
| Wilmington | 78 | 82 | 90 | 30.03 | 30.12 | − .02 | 41.3 | − 5.6 | 70 | 22 | 50 | 15 | 6 | 32 | 35 | 36 | 31 | 75 | 3.24 | − 0.7 | 14 | 6,829 | n. | 33 | nw. | 11 | 13 | 7 | 11 | 4.8 | 4.5 |
| Charleston | 48 | 14 | 92 | 30.09 | 30.14 | − .01 | 45.2 | − 4.8 | 68 | 22 | 53 | 23 | 5 | 38 | 28 | 39 | 34 | 70 | 3.49 | − 0.5 | 12 | 8,571 | n. | 38 | n. | 3 | 9 | 13 | 9 | 5.3 | T. |
| Columbia, S. C. | 351 | 167 | 175 | 29.74 | 30.13 | − .02 | 41.5 | − 4.1 | 68 | 21 | 49 | 18 | 5 | 33 | 36 | 36 | 31 | 73 | 2.62 | − 1.2 | 11 | 7,644 | sw. | 36 | s. | 22 | 9 | 8 | 14 | 6.2 | T. |
| Augusta | 180 | 89 | 97 | 29.94 | 30.14 | − .02 | 42.0 | − 4.6 | 70 | 21 | 51 | 19 | 5 | 33 | 32 | 36 | 31 | 72 | 2.61 | − 1.9 | 11 | 5,113 | w. | 37 | nw. | 13 | 12 | 9 | 10 | 5.1 | |
| Savannah | 65 | 79 | 89 | 30.07 | 30.14 | − .01 | 46.4 | − 4.6 | 70 | 2 | 54 | 23 | 5 | 38 | 26 | 40 | 35 | 72 | 3.77 | + 0.5 | 13 | 6,609 | n. | 26 | sw. | 11 | 11 | 11 | 9 | 5.0 | |
| Jacksonville | 43 | 101 | 129 | 30.06 | 30.11 | − .04 | 50.3 | − 4.9 | 75 | 22 | 58 | 28 | 5 | 42 | 29 | 45 | 41 | 79 | 6.77 | + 3.5 | 8 | 7,850 | n. | 37 | nw. | 13 | 11 | 9 | 11 | 5.5 | |
| *Florida Peninsula.* | | | | | | | 65.1 | − 1.6 | | | | | | | | | | 83 | 5.07 | + 0.7 | | | | | | | | | | 5.2 | |
| Jupiter | 28 | 10 | 48 | 30.06 | 30.09 | − .01 | 64.3 | − 1.4 | 80 | 29 | 72 | 39 | 15 | 56 | 32 | 59 | 56 | 81 | 2.56 | − 1.3 | 13 | 8,990 | n. | 36 | s. | 22 | 9 | 16 | 6 | 5.0 | |
| Key West | 22 | 10 | 53 | 30.05 | 30.07 | − .03 | 67.6 | − 2.1 | 80 | 29 | 73 | 54 | 15 | 62 | 21 | 63 | 61 | 85 | 1.42 | − 0.7 | 7 | 7,834 | ne. | 31 | n. | 24 | 9 | 17 | 5 | 5.0 | |
| Sand Key | 24 | | | 30.03 | 30.06 | | 67.8 | ... | 78 | 2 | 72 | 54 | 14 | 63 | 18 | ... | ... | ... | 1.00 | ... | 7 | 13,145 | ne. | 48 | ne. | 19 | 7 | 19 | 5 | 5.2 | |
| Tampa | 34 | 60 | 67 | 30.07 | 30.11 | − .01 | 57.5 | − 1.2 | 78 | 22 | 66 | 37 | 14 | 49 | 28 | 52 | 49 | 83 | 6.73 | + 4.0 | 12 | 5,131 | n. | 26 | sw. | 11 | 9 | 11 | 11 | 5.4 | |
| *East Gulf States.* | | | | | | | 45.4 | − 3.0 | | | | | | | | | | 70 | 3.71 | − 1.6 | | | | | | | | | | 5.3 | |
| Atlanta | 1,174 | 190 | 216 | 28.86 | 30.12 | − .03 | 38.8 | − 3.7 | 63 | 22 | 47 | 15 | 27 | 31 | 30 | 34 | 28 | 68 | 3.62 | − 2.1 | 12 | 10,302 | nw. | 48 | nw. | 2 | 12 | 6 | 13 | 5.3 | 7.6 |
| Macon | 370 | 93 | 99 | 29.74 | 30.15 | − .01 | 42.4 | ... | 68 | 21 | 52 | 19 | 5 | 33 | 33 | ... | ... | ... | 2.85 | ... | 12 | 4,617 | nw. | 27 | s. | 22 | 11 | 7 | 13 | 5.5 | T. |
| Pensacola | 56 | 79 | 96 | 30.07 | 30.14 | .00 | 49.8 | − 2.7 | 68 | 2 | 57 | 29 | 27 | 42 | 26 | ... | ... | ... | 3.47 | − 1.2 | 8 | 8,247 | ne. | 40 | w. | 16 | 15 | 5 | 11 | 4.8 | |
| Birmingham | 700 | 136 | 143 | 29.35 | 30.14 | − .02 | 41.6 | − 4.1 | 66 | 22 | 50 | 15 | 27 | 33 | 32 | ... | ... | ... | 3.84 | − 1.9 | 9 | 6,823 | se. | 50 | se. | 22 | 10 | 7 | 14 | 5.7 | 8.1 |
| Mobile | 57 | 88 | 96 | 30.06 | 30.13 | − .02 | 47.9 | − 2.6 | 70 | 2 | 57 | 27 | 27 | 39 | 29 | 43 | 38 | 71 | 3.77 | − 1.3 | 8 | 6,271 | n. | 36 | nw. | 16 | 9 | 14 | 8 | 5.0 | |
| Montgomery | 223 | 100 | 112 | 29.89 | 30.13 | − .03 | 44.2 | − 4.1 | 66 | 21 | 54 | 22 | 3 | 35 | 35 | 40 | 36 | 77 | 4.31 | − 1.1 | 11 | 5,474 | n. | 36 | sw. | 22 | 10 | 9 | 12 | 5.5 | T. |
| Meridian | 375 | 84 | 93 | 29.72 | 30.13 | − .03 | 43.4 | − 3.6 | 70 | 21 | 54 | 16 | 30 | 32 | 38 | ... | ... | ... | 4.31 | − 0.8 | 9 | 5,123 | sw. | 28 | sw. | 22 | 11 | 10 | 10 | 5.0 | 7.6 |
| Vicksburg | 247 | 62 | 74 | 29.84 | 30.10 | − .05 | 46.2 | − 1.1 | 71 | 21 | 55 | 22 | 27 | 37 | 30 | 39 | 33 | 64 | 2.81 | − 2.7 | 9 | 6,656 | se. | 38 | w. | 22 | 10 | 6 | 15 | 5.6 | 5.5 |
| New Orleans | 51 | 88 | 121 | 30.07 | 30.13 | .00 | 51.4 | − 2.4 | 75 | 16 | 60 | 31 | 30 | 43 | 27 | 45 | 40 | 72 | 3.58 | − 1.6 | 10 | 7,717 | n. | 34 | s. | 22 | 13 | 8 | 10 | 5.0 | |
| *West Gulf States.* | | | | | | | 47.1 | + 0.5 | | | | | | | | | | 67 | 1.40 | − 2.1 | | | | | | | | | | 4.1 | |
| Shreveport | 249 | 77 | 84 | 29.85 | 30.13 | − .01 | 45.2 | − 0.7 | 71 | 20 | 55 | 13 | 26 | 35 | 40 | 39 | 32 | 64 | 1.59 | − 3.0 | 11 | 6,481 | se. | 32 | se. | 21 | 18 | 5 | 8 | 3.7 | |
| Fort Smith | 457 | 79 | 94 | 29.60 | 30.09 | − .05 | 38.8 | + 2.7 | 70 | 20 | 50 | 3 | 26 | 28 | 41 | 33 | 26 | 67 | 3.48 | + 1.1 | 4 | 7,505 | e. | 35 | s. | 20 | 10 | 15 | 6 | 4.6 | 5.0 |
| Little Rock | 357 | 93 | 100 | 29.72 | 30.11 | − .04 | 41.2 | + 0.4 | 66 | 20 | 51 | 9 | 26 | 32 | 38 | 35 | 27 | 63 | 2.58 | − 2.3 | 9 | 6,880 | nw. | 33 | nw. | 13 | 17 | 6 | 8 | 4.1 | T. |
| Corpus Christi | 20 | 48 | 53 | 30.09 | 30.11 | + .01 | 55.4 | − 0.1 | 84 | 21 | 64 | 29 | 29 | 46 | 34 | 19 | 43 | 69 | 0.20 | − 2.7 | 8 | 7,536 | n. | 36 | nw. | 21 | 12 | 13 | 6 | 4.6 | |
| Fort Worth | 670 | 106 | 114 | 29.40 | 30.13 | + .01 | 44.6 | ... | 78 | 15 | 57 | 12 | 26 | 32 | 41 | ... | ... | ... | 1.30 | ... | 2 | 9,608 | nw. | 36 | sw. | 9 | 21 | 6 | 4 | 3.5 | T. |
| Galveston | 54 | 106 | 112 | 30.04 | 30.10 | − .03 | 51.6 | − 1.1 | 67 | 1 | 57 | 30 | 26 | 46 | 23 | 49 | 46 | 82 | 1.01 | − 2.7 | 6 | 9,734 | s. | 42 | nw. | 26 | 15 | 11 | 5 | 3.7 | |
| Palestine | 510 | 73 | 79 | 29.58 | 30.13 | + .01 | 45.7 | + 1.9 | 74 | 20 | 56 | 13 | 26 | 36 | 40 | 39 | 33 | 68 | 0.66 | − 3.6 | 7 | 7,387 | nw. | 35 | nw. | 21 | 13 | 9 | 9 | 4.4 | |
| San Antonio | 701 | 80 | 91 | 29.36 | 30.10 | .00 | 51.6 | + 0.1 | 79 | 19 | 64 | 22 | 29 | 39 | 39 | 42 | 33 | 56 | 0.30 | − 1.4 | 1 | 5,756 | se. | 34 | n. | 25 | 17 | 6 | 8 | 4.0 | |
| Taylor | 583 | 55 | 63 | 29.50 | 30.13 | + .02 | 47.1 | ... | 76 | 20 | 60 | 16 | 26 | 34 | 48 | ... | ... | ... | 0.03 | ... | 1 | 6,377 | nw. | 32 | nw. | 2 | 12 | 12 | 7 | 4.4 | |
| *Ohio Val. and Tenn.* | | | | | | | 30.4 | − 3.9 | | | | | | | | | | 77 | 2.65 | − 1.6 | | | | | | | | | | 6.2 | |
| Chattanooga | 762 | 106 | 112 | 29.31 | 30.15 | − .01 | 37.6 | − 3.4 | 64 | 22 | 46 | 14 | 3 | 29 | 37 | 32 | 26 | 67 | 2.58 | − 3.6 | 12 | 6,059 | s. | 36 | nw. | 2 | 10 | 10 | 11 | 5.4 | 5.2 |
| Knoxville | 1,004 | 35 | 88 | 29.04 | 30.12 | − .03 | 35.3 | − 2.4 | 66 | 22 | 44 | 12 | 3 | 26 | 38 | 31 | 26 | 73 | 2.02 | − 3.5 | 11 | 6,115 | sw. | 40 | s. | 22 | 12 | 6 | 13 | 5.5 | 2.9 |
| Memphis | 397 | 146 | 154 | 29.69 | 30.13 | − .03 | 39.5 | − 0.4 | 64 | 21 | 48 | 6 | 26 | 32 | 35 | 35 | 28 | 67 | 3.34 | − 2.2 | 11 | 7,012 | s. | 38 | nw. | 25 | 11 | 7 | 13 | 5.4 | 1.6 |
| Nashville | 546 | 122 | 134 | 29.53 | 30.13 | − .03 | 36.4 | − 1.8 | 62 | 21 | 45 | 9 | 26 | 28 | 40 | 32 | 27 | 74 | 3.93 | − 1.2 | 12 | 6,235 | s. | 35 | s. | 21 | 11 | 8 | 12 | 5.3 | 3.6 |
| Lexington | 989 | 75 | 102 | 28.99 | 30.11 | − .02 | 29.6 | − 3.5 | 61 | 22 | 38 | 2 | 27 | 22 | 35 | ... | ... | ... | 1.92 | − 1.9 | 13 | 9,312 | s. | 48 | w. | 22 | 10 | 10 | 11 | 5.5 | 4.8 |
| Louisville | 525 | 114 | 136 | 29.52 | 30.12 | − .02 | 31.2 | − 2.9 | 59 | 20 | 39 | 5 | 27 | 23 | 34 | 28 | 24 | 76 | 2.43 | − 1.6 | 13 | 6,991 | sw. | 34 | sw. | 26 | 14 | 2 | 15 | 5.7 | 1.1 |
| Evansville | 431 | 72 | 82 | 29.61 | 30.09 | − .05 | 29.8 | ... | 57 | 20 | 38 | − 2 | 27 | 22 | 27 | ... | ... | ... | 3.87 | ... | 12 | 6,090 | s. | 29 | s. | 20 | 8 | 12 | 11 | 5.7 | 6.5 |
| Indianapolis | 822 | 154 | 164 | 29.17 | 30.10 | − .02 | 22.2 | − 6.1 | 50 | 20 | 30 | − 7 | 27 | 14 | 30 | 20 | 18 | 88 | 3.87 | + 0.9 | 14 | 8,106 | ne. | 36 | sw. | 24 | 11 | 7 | 13 | 5.5 | 13.4 |
| Cincinnati | 628 | 152 | 160 | 29.41 | 30.11 | − .01 | 27.0 | − 5.5 | 60 | 22 | 35 | 1 | 27 | 18 | 32 | 25 | 22 | 80 | 2.66 | − 0.8 | 11 | 5,882 | sw. | 37 | sw. | 22 | 8 | 8 | 15 | 6.6 | 5.6 |
| Columbus | 824 | 173 | 190 | 29.18 | 30.10 | − .01 | 22.8 | − 5.6 | 62 | 22 | 31 | − 8 | 4 | 14 | 32 | 21 | 18 | 86 | 2.80 | − 0.5 | 11 | 8,958 | sw. | 61 | sw. | 22 | 6 | 10 | 15 | 6.6 | 14.1 |
| Pittsburg | 842 | 116 | 123 | 29.15 | 30.10 | − .01 | 25.3 | − 5.3 | 66 | 22 | 33 | − 2 | 5 | 18 | 37 | 23 | 18 | 76 | 2.31 | − 0.8 | 13 | 4,780 | nw. | 28 | nw. | 24 | 3 | 8 | 20 | 7.7 | 6.6 |
| Parkersburg | 638 | 77 | 84 | 29.42 | 30.13 | + .01 | 27.1 | − 5.9 | 67 | 22 | 35 | − 2 | 4 | 19 | 34 | 25 | 21 | 78 | 1.24 | − 2.3 | 14 | 4,549 | s. | 28 | w. | 26 | 0 | 11 | 20 | 8.4 | 4.6 |
| Elkins | 1,940 | 41 | 50 | 27.96 | 30.08 | − .04 | 25.9 | ... | 62 | 22 | 36 | − 6 | 4 | 16 | 40 | 23 | 19 | 80 | 2.75 | ... | 21 | 3,593 | w. | 24 | s. | 22 | 5 | 6 | 20 | 7.5 | 13.9 |
| *Lower Lake Region.* | | | | | | | 18.6 | − 6.7 | | | | | | | | | | 83 | 4.12 | + 1.5 | | | | | | | | | | 7.5 | |
| Buffalo | 767 | 178 | 206 | 29.19 | 30.06 | − .01 | 19.2 | − 5.2 | 54 | 22 | 26 | − 4 | 5 | 12 | 34 | 18 | 13 | 77 | 4.78 | + 1.8 | 24 | 12,468 | w. | 58 | w. | 24 | 1 | 6 | 24 | 8.5 | 39.2 |
| Oswego | 335 | 76 | 91 | 29.68 | 30.06 | − .01 | 16.4 | − 7.9 | 49 | 22 | 24 | −22 | 19 | 9 | 38 | 16 | 14 | 89 | 3.58 | + 0.6 | 20 | 10,027 | s. | 41 | nw. | 16 | 1 | 7 | 23 | 8.6 | 26.6 |
| Rochester | 523 | 81 | 102 | 29.47 | 30.07 | .00 | 18.6 | − 5.3 | 51 | 22 | 26 | −14 | 5 | 12 | 27 | 17 | 14 | 83 | 3.39 | + 0.2 | 17 | 7,784 | sw. | 39 | sw. | 22 | 2 | 7 | 22 | 8.0 | 27.2 |
| Syracuse | 597 | 97 | 113 | 29.42 | 30.09 | + .02 | 16.9 | ... | 52 | 22 | 24 | −20 | 19 | 9 | 34 | ... | ... | ... | 4.50 | ... | 19 | 9,639 | s. | 49 | s. | 22 | 2 | 13 | 16 | 7.4 | 39.0 |
| Erie | 713 | 92 | 102 | 29.26 | 30.07 | − .01 | 19.2 | − 7.7 | 54 | 22 | 26 | − 7 | 5 | 12 | 38 | 18 | 15 | 83 | 4.94 | + 1.6 | 18 | 8,580 | sw. | 37 | s. | 22 | 1 | 5 | 25 | 8.2 | 21.5 |
| Cleveland | 762 | 190 | 201 | 29.22 | 30.08 | − .01 | 19.7 | − 6.5 | 52 | 22 | 27 | − 5 | 5 | 12 | 41 | 18 | 15 | 81 | 4.69 | + 2.2 | 21 | 11,773 | se. | 56 | ne. | 2 | 5 | 8 | 18 | 7.2 | 21.6 |
| Sandusky | 629 | 62 | 70 | 29.36 | 30.08 | − .01 | 19.8 | − 6.7 | 46 | 22 | 27 | − 6 | 3 | 13 | 38 | ... | ... | ... | 4.70 | + 2.5 | 15 | 6,364 | sw. | 29 | nw. | 16 | 8 | 14 | 9 | 5.5 | 15.7 |
| Toledo | 628 | 120 | 127 | 29.37 | 30.09 | .00 | 18.4 | − 7.7 | 40 | 19 | 25 | − 8 | 3 | 11 | 35 | 16 | 13 | 82 | 3.51 | + 1.4 | 12 | 7,307 | sw. | 32 | w. | 16 | 6 | 10 | 15 | 6.7 | 10.6 |
| Detroit | 730 | 153 | 193 | 29.24 | 30.07 | − .01 | 17.6 | − 6.9 | 42 | 20 | 24 | − 6 | 25 | 11 | 34 | 17 | 15 | 89 | 3.34 | + 1.4 | 14 | 8,226 | sw. | 35 | nw. | 16 | 7 | 3 | 21 | 7.1 | 20.1 |
| *Upper Lake Region.* | | | | | | | 12.2 | − 5.3 | | | | | | | | | | 83 | 1.19 | − 0.8 | | | | | | | | | | 6.7 | |
| Alpena | 609 | 63 | 80 | 29.37 | 30.07 | + .03 | 13.6 | − 4.5 | 34 | 20 | 21 | −13 | 29 | 6 | 32 | 12 | 10 | 87 | 0.97 | − 1.5 | 14 | 7,882 | w. | 38 | s. | 19 | 5 | 8 | 18 | 7.4 | 10.2 |
| Escanaba | 612 | 40 | 48 | 29.38 | 30.09 | + .04 | 10.7 | − 3.3 | 34 | 8 | 18 | −22 | 25 | 3 | 28 | 10 | 9 | 92 | 0.46 | − 1.1 | 9 | 5,331 | nw. | 27 | nw. | 16 | 4 | 8 | 19 | 7.3 | 5.2 |
| Grand Rapids | 707 | 127 | 165 | 29.27 | 30.08 | + .01 | 17.3 | − 6.5 | 41 | 19 | 24 | −10 | 25 | 11 | 34 | 16 | 14 | 87 | 1.47 | − 1.5 | 16 | 7,709 | ne. | 35 | w. | 24 | 1 | 9 | 21 | 8.5 | 15.6 |
| Houghton | 668 | 66 | 74 | 29.30 | 30.07 | + .02 | 11.1 | ... | 38 | 7 | 18 | −25 | 27 | 4 | 33 | ... | ... | ... | 4.16 | ... | 20 | 4,999 | nw. | 24 | n. | 8 | 8 | 5 | 18 | 7.0 | 40.8 |
| Marquette | 734 | 76 | 116 | 29.23 | 30.08 | + .04 | 12.4 | − 3.6 | 36 | 7 | 19 | −15 | 24 | 6 | 22 | 10 | 7 | 79 | 2.30 | + 0.3 | 19 | 8,723 | nw. | 46 | s. | 9 | 3 | 6 | 22 | 7.7 | 28.9 |
| Port Huron | 638 | 70 | 120 | 29.37 | 30.10 | + .04 | 15.0 | − 6.8 | 37 | 20 | 22 | −13 | 25 | 8 | 40 | 14 | 12 | 86 | 1.76 | − 0.3 | 15 | 8,282 | nw. | 31 | nw. | 16 | 6 | 8 | 17 | 7.2 | 18.4 |
| Sault Ste. Marie | 614 | 40 | 61 | 29.33 | 30.05 | + .02 | 6.5 | − 7.8 | 30 | 7 | 16 | −23 | 4 | − 3 | 36 | 6 | 2 | 80 | 0.67 | − 1.1 | 10 | 5,923 | nw. | 36 | nw. | 24 | 9 | 8 | 14 | 6.1 | 6.7 |
| Chicago | 823 | 241 | 274 | 29.17 | 30.10 | .00 | 17.7 | − 5.7 | 39 | 19 | 24 | −15 | 25 | 11 | 27 | 17 | 14 | 85 | 2.25 | + 0.1 | 13 | 12,614 | nw. | 54 | ne. | 2 | 7 | 9 | 15 | 6.5 | 11.0 |
| Milwaukee | 681 | 124 | 142 | 29.33 | 30.11 | + .03 | 14.9 | − 4.5 | 39 | 19 | 22 | −23 | 25 | 8 | 29 | 13 | 9 | 77 | 1.36 | − 0.8 | 13 | 9,251 | w. | 49 | se. | 19 | 11 | 8 | 12 | 5.1 | 14.6 |
| Green Bay | 617 | 49 | 86 | 29.40 | 30.11 | + .05 | 9.4 | − 4.8 | 36 | 8 | 18 | −27 | 25 | 1 | 32 | 8 | 4 | 77 | 0.45 | − 1.4 | 7 | 7,553 | sw. | 38 | ne. | 21 | 7 | 8 | 16 | 6.6 | 5.7 |
| Duluth | 1,133 | 11 | 47 | 28.81 | 30.11 | + .02 | 4.4 | − 5.6 | 37 | 7 | 13 | −37 | 24 | − 4 | 28 | 2 | −1 | 80 | 0.20 | − 0.9 | 7 | 10,371 | nw. | 48 | nw. | 12 | 15 | 7 | 9 | 4.5 | 2.2 |

TABLE I.—*Climatological data for Weather Bureau stations, January, 1904*—Continued.

| Stations. | Elevation of instruments: Barometer above sea level, feet. | Elevation of instruments: Thermometers above ground. | Elevation of instruments: Anemometer above ground. | Pressure, in inches: Actual, reduced to mean of 24 hours. | Pressure, in inches: Sea level, reduced to mean of 24 hrs. | Pressure, in inches: Departure from normal. | Temperature: Mean max. + mean min. ÷ 2. | Temperature: Departure from normal. | Temperature: Maximum. | Temperature: Date. | Temperature: Mean maximum. | Temperature: Minimum. | Temperature: Date. | Temperature: Mean minimum. | Temperature: Greatest daily range. | Mean wet thermometer. | Mean temperature of the dew-point. | Mean relative humidity, per cent. | Precipitation: Total. | Precipitation: Departure from normal. | Precipitation: Days with .01, or more. | Wind: Total movement, miles. | Wind: Prevailing direction. | Wind: Maximum velocity: Miles per hour. | Wind: Maximum velocity: Direction. | Wind: Maximum velocity: Date. | Clear days. | Partly cloudy days. | Cloudy days. | Average cloudiness, tenths. | Total snowfall. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *North Dakota.* | | | | | | | **4.3** | **+ 1.8** | | | | | | | | | | **76** | **0.53** | **− 0.1** | | | | | | | | | | **5.3** | |
| Moorhead | 935 | 54 | 60 | 29.08 | 30.16 | + .02 | 3.6 | + 4.5 | 36 | 7 | 13 | −36 | 24 | − 5 | 29 | 2 | 0 | 87 | 0.42 | − 0.3 | 9 | 6,442 | nw. | 47 | se. | 18 | 11 | 10 | 10 | 5.0 | 4.2 |
| Bismarck | 1,674 | 16 | 29 | 28.26 | 30.17 | + .04 | 5.2 | + 0.7 | 39 | 15 | 14 | −35 | 25 | − 4 | 38 | 2 | −6 | 64 | 0.58 | 0.0 | 8 | 6,630 | nw. | 40 | n. | 18 | 15 | 5 | 11 | 5.0 | 5.8 |
| Williston | 1,875 | 14 | 44 | 27.98 | 30.08 | − .03 | 4.2 | + 0.3 | 37 | 14 | 15 | −34 | 25 | − 7 | 43 | 3 | 1 | 78 | 0.58 | 0.0 | 11 | 5,652 | w. | 42 | n. | 30 | 9 | 6 | 16 | 5.9 | 7.1 |
| *Upper Miss. Valley.* | | | | | | | **17.5** | **− 3.6** | | | | | | | | | | **80** | **1.80** | **0.0** | | | | | | | | | | **5.3** | |
| Minneapolis | ... | 99 | 208 | ... | ... | ... | 7.2 | − 4.7 | 38 | 7 | 14 | −33 | 24 | 0 | 23 | ... | ... | ... | 0.43 | − 0.4 | 5 | 8,624 | nw. | 50 | se. | 18 | 10 | 7 | 14 | ... | 8.5 |
| St. Paul | 837 | 102 | 122 | 29.17 | 30.14 | + .03 | 7.6 | − 3.0 | 38 | 7 | 15 | −33 | 24 | 0 | 25 | 6 | 3 | 82 | 0.41 | − 0.6 | 5 | 6,309 | nw. | 28 | se. | 18 | 17 | 5 | 9 | 4.5 | 7.2 |
| La Crosse | 714 | 71 | 87 | 29.32 | 30.14 | + .03 | 9.9 | − 4.8 | 40 | 7 | 18 | −27 | 25 | 2 | 30 | ... | ... | ... | 0.32 | − 1.0 | 5 | 5,340 | s. | 25 | nw. | 7 | 14 | 9 | 8 | 4.7 | 4.1 |
| Davenport | 606 | 71 | 79 | 29.42 | 30.10 | − .02 | 16.4 | − 3.6 | 46 | 19 | 24 | −13 | 25 | 9 | 24 | 15 | 13 | 86 | 2.20 | + 0.5 | 7 | 5,979 | nw. | 26 | e. | 20 | 10 | 12 | 9 | 5.4 | 3.6 |
| Des Moines | 861 | 84 | 99 | 29.18 | 30.15 | + .01 | 15.6 | − 1.9 | 50 | 7 | 24 | −18 | 25 | 7 | 31 | 14 | 10 | 79 | 1.22 | − 0.1 | 8 | 6,291 | nw. | 28 | se. | 18 | 7 | 6 | 18 | 6.7 | 5.0 |
| Dubuque | 698 | 100 | 117 | 29.34 | 30.14 | + .02 | 13.4 | − 3.9 | 45 | 19 | 22 | −23 | 25 | 5 | 29 | 11 | 7 | 78 | 0.51 | − 1.2 | 8 | 5,239 | nw. | 34 | se. | 19 | 13 | 8 | 10 | 5.2 | 4.8 |
| Keokuk | 614 | 63 | 78 | 29.41 | 30.10 | − .04 | 18.4 | − 4.8 | 47 | 19 | 25 | −13 | 26 | 12 | 25 | 16 | 13 | 79 | 2.70 | + 1.0 | 11 | 5,673 | nw. | 24 | n. | 2 | 15 | 6 | 10 | 4.8 | 8.8 |
| Cairo | 356 | 87 | 93 | 29.73 | 30.12 | − .04 | 33.6 | − 1.1 | 61 | 20 | 42 | 1 | 26 | 25 | 36 | 30 | 26 | 78 | 4.05 | + 0.2 | 13 | 7,454 | s. | 33 | n. | 21 | 8 | 12 | 11 | 5.9 | 2.9 |
| Springfield, Ill | 644 | 82 | 93 | 29.38 | 30.10 | − .03 | 21.0 | − 4.5 | 52 | 20 | 29 | − 9 | 3 | 13 | 28 | 19 | 17 | 86 | 1.98 | − 0.1 | 11 | 7,686 | nw. | 26 | w. | 23 | 10 | 8 | 13 | 5.4 | 11.9 |
| Hannibal | 534 | 75 | 109 | 29.50 | 30.10 | − .03 | 21.3 | − 4.6 | 52 | 19 | 30 | −15 | 3 | 13 | 36 | ... | ... | ... | 2.81 | + 0.6 | 11 | 6,836 | nw. | 31 | ne. | 1 | 13 | 5 | 13 | 5.4 | 13.6 |
| St. Louis | 567 | 208 | 217 | 29.46 | 30.09 | − .05 | 27.8 | − 2.7 | 58 | 20 | 36 | − 6 | 26 | 20 | 28 | 24 | 19 | 74 | 3.15 | + 1.0 | 11 | 8,759 | nw. | 36 | nw. | 31 | 17 | 3 | 11 | 4.6 | 14.3 |
| *Missouri Valley.* | | | | | | | **20.9** | **+ 1.0** | | | | | | | | | | **77** | **0.90** | **− 0.1** | | | | | | | | | | **5.4** | |
| Columbia, Mo | 784 | 11 | 84 | 29.22 | 30.09 | − .04 | 25.8 | − 4.8 | 63 | 20 | 35 | −14 | 29 | 16 | 42 | ... | ... | ... | 2.09 | − 0.2 | 12 | 7,077 | s. | 29 | n. | 2 | 9 | 7 | 15 | 6.0 | 9.6 |
| Kansas City | 963 | 78 | 95 | 29.05 | 30.12 | − .05 | 26.8 | + 1.4 | 56 | 19 | 35 | − 8 | 26 | 19 | 32 | 23 | 20 | 78 | 0.77 | − 0.4 | 11 | 6,376 | nw. | 25 | nw. | 22 | 14 | 7 | 10 | 4.8 | 3.3 |
| Springfield, Mo | 1,324 | 98 | 104 | 28.63 | 30.08 | − .06 | 32.4 | + 0.1 | 65 | 20 | 42 | − 8 | 26 | 23 | 41 | 28 | 24 | 76 | 3.32 | + 0.8 | 8 | 8,882 | nw. | 34 | se. | 18 | 19 | 2 | 10 | 4.1 | 2.3 |
| Topeka | ... | 85 | 89 | ... | ... | ... | 26.6 | − 0.2 | 57 | 8 | 36 | −10 | 26 | 18 | 37 | ... | ... | ... | 0.92 | − 0.1 | 8 | 7,132 | nw. | 29 | s. | 19 | 11 | 10 | 10 | 4.9 | 1.8 |
| Lincoln | 1,189 | 75 | 84 | 28.78 | 30.11 | − .04 | 22.2 | + 4.5 | 60 | 8 | 32 | −14 | 25 | 13 | 38 | 18 | 13 | 74 | 0.60 | − 0.1 | 12 | 8,180 | n. | 37 | se. | 18 | 10 | 11 | 10 | 5.3 | 5.6 |
| Omaha | 1,105 | 115 | 121 | 28.88 | 30.12 | − .03 | 19.8 | + 0.6 | 54 | 7 | 28 | −17 | 25 | 12 | 26 | 17 | 13 | 81 | 0.62 | − 0.1 | 13 | 7,618 | n. | 34 | n. | 1 | 6 | 12 | 13 | 6.1 | 4.9 |
| Valentine | 2,598 | 47 | 54 | 27.28 | 30.11 | − .01 | 21.6 | + 4.7 | 56 | 8 | 33 | −17 | 25 | 10 | 44 | 18 | 12 | 69 | 0.53 | − 0.1 | 6 | 7,447 | nw. | 38 | nw. | 7 | 15 | 4 | 12 | 5.1 | 5.3 |
| Sioux City | 1,135 | 96 | 164 | 28.84 | 30.12 | − .03 | 15.1 | − 1.2 | 46 | 7 | 23 | −21 | 25 | 7 | 29 | ... | ... | ... | 0.09 | − 0.5 | 6 | 9,396 | nw. | 50 | se. | 18 | 7 | 11 | 13 | 5.9 | 4.3 |
| Pierre | 1,572 | 43 | 50 | 28.40 | 30.15 | + .02 | 16.0 | + 3.3 | 49 | 8 | 24 | −19 | 24 | 8 | 32 | 13 | 8 | 74 | 0.63 | + 0.1 | 9 | 4,952 | e. | 31 | w. | 7 | 8 | 12 | 11 | 6.0 | 5.8 |
| Huron | 1,306 | 56 | 67 | 28.67 | 30.16 | .00 | 8.0 | + 1.0 | 38 | 7 | 17 | −31 | 24 | − 1 | 34 | 7 | 4 | 85 | 0.14 | − 0.4 | 6 | 8,069 | nw. | 42 | e. | 18 | 10 | 8 | 13 | 5.7 | 2.0 |
| Yankton | 1,233 | 42 | 49 | 28.73 | 30.12 | − .04 | 15.8 | + 1.6 | 48 | 7 | 25 | −24 | 24 | 7 | 38 | ... | ... | ... | 0.21 | − 0.4 | 6 | 5,581 | nw. | 34 | se. | 18 | 8 | 14 | 9 | 5.6 | 1.6 |
| *Northern Slope.* | | | | | | | **24.0** | **+ 6.5** | | | | | | | | | | **76** | **0.38** | **− 0.2** | | | | | | | | | | **5.8** | |
| Havre | 2,505 | 11 | 44 | 27.31 | 30.04 | − .06 | 20.6 | +10.9 | 56 | 8 | 32 | −13 | 20 | 10 | 40 | 18 | 15 | 83 | 0.15 | − 0.7 | 7 | 8,472 | sw. | 48 | w. | 13 | 9 | 13 | 9 | 5.4 | 1.5 |
| Miles City | 2,371 | 42 | 50 | 27.43 | 30.04 | − .08 | 22.5 | +11.9 | 56 | 8 | 31 | −14 | 25 | 14 | 44 | 20 | 18 | 91 | 0.44 | − 0.1 | 8 | 4,719 | s. | 34 | nw. | 9 | 10 | 11 | 10 | 5.4 | 4.4 |
| Helena | 4,110 | 88 | 94 | 25.78 | 30.09 | − .06 | 29.4 | +12.3 | 50 | 7 | 37 | 2 | 20 | 22 | 29 | 25 | 18 | 64 | 0.38 | − 1.0 | 8 | 7,034 | sw. | 43 | sw. | 9 | 3 | 11 | 17 | 7.2 | 6.7 |
| Kalispell | 2,965 | 45 | 51 | 26.94 | 30.09 | − .03 | 27.5 | ... | 46 | 14 | 33 | 9 | 31 | 22 | 23 | 26 | 23 | 81 | 1.12 | ... | 15 | 3,125 | w. | 32 | sw. | 9 | 2 | 11 | 18 | 7.4 | 11.1 |
| Rapid City | 3,234 | 46 | 50 | 26.55 | 30.07 | − .03 | 23.5 | − 3.3 | 60 | 13 | 34 | −17 | 25 | 13 | 46 | 20 | 17 | 80 | 0.46 | + 0.1 | 8 | 5,554 | nw. | 42 | sw. | 18 | 10 | 6 | 15 | 6.1 | 4.6 |
| Cheyenne | 6,088 | 56 | 64 | 23.90 | 30.08 | + .03 | 25.4 | + 0.4 | 56 | 14 | 36 | − 2 | 28 | 15 | 33 | 19 | 9 | 54 | 0.35 | 0.0 | 8 | 10,336 | nw. | 50 | w. | 18 | 9 | 14 | 8 | 5.1 | 3.8 |
| Lander | 5,372 | 26 | 36 | 24.59 | 30.16 | + .04 | 20.4 | + 0.5 | 55 | 14 | 35 | −11 | 28 | 6 | 40 | 16 | 12 | 75 | 0.56 | + 0.2 | 4 | 2,469 | sw. | 32 | sw. | 16 | 8 | 18 | 5 | 4.9 | 5.6 |
| Yellowstone Park | 6,200 | 11 | 47 | 23.84 | 30.20 | + .06 | 18.6 | ... | 40 | 17 | 26 | − 1 | 25 | 12 | 25 | 16 | 12 | 76 | 0.93 | ... | 16 | 6,119 | s. | 28 | s. | 16 | 4 | 17 | 10 | 6.3 | 19.4 |
| North Platte | 2,821 | 43 | 52 | 27.08 | 30.12 | .00 | 26.4 | + 6.4 | 59 | 8 | 39 | − 8 | 25 | 13 | 39 | 21 | 17 | 77 | 0.32 | − 0.2 | 6 | 6,523 | nw. | 32 | nw. | 30 | 10 | 18 | 3 | 4.6 | 1.2 |
| *Middle Slope.* | | | | | | | **30.9** | **+ 1.9** | | | | | | | | | | **65** | **0.50** | **− 0.2** | | | | | | | | | | **4.0** | |
| Denver | 5,291 | 79 | 151 | 24.65 | 30.06 | + .01 | 31.0 | + 2.8 | 64 | 14 | 43 | − 2 | 28 | 19 | 39 | 25 | 18 | 63 | 0.04 | − 0.5 | 2 | 6,901 | s. | 40 | nw. | 13 | 15 | 13 | 3 | 3.8 | 1.1 |
| Pueblo | 4,685 | 80 | 86 | 25.24 | 30.05 | .00 | 29.2 | + 0.5 | 67 | 13 | 45 | − 2 | 26 | 13 | 52 | 22 | 10 | 49 | 0.14 | − 0.3 | 2 | 4,636 | nw. | 40 | w. | 24 | 16 | 10 | 5 | 3.7 | 1.4 |
| Concordia | 1,398 | 42 | 47 | 28.58 | 30.12 | − .02 | 26.4 | + 3.2 | 62 | 8 | 36 | −10 | 26 | 16 | 46 | 22 | 19 | 78 | 0.51 | − 0.1 | 6 | 5,333 | n. | 26 | se. | 18 | 13 | 9 | 9 | 4.8 | 1.5 |
| Dodge | 2,509 | 44 | 54 | 27.42 | 30.12 | + .01 | 30.0 | + 3.4 | 67 | 18 | 44 | − 2 | 26 | 16 | 43 | 23 | 16 | 66 | 0.03 | − 0.4 | 2 | 7,662 | nw. | 40 | se. | 18 | 15 | 8 | 8 | 4.1 | 0.1 |
| Wichita | 1,358 | 78 | 86 | 28.62 | 30.11 | − .02 | 32.6 | + 2.0 | 70 | 19 | 44 | − 6 | 26 | 21 | 41 | 27 | 21 | 72 | 0.12 | − 0.8 | 2 | 7,239 | n. | 32 | n. | 2 | 17 | 9 | 5 | 4.2 | 0.8 |
| Oklahoma | 1,214 | 79 | 86 | 28.76 | 30.08 | − .03 | 36.3 | − 0.7 | 67 | 15 | 47 | 3 | 26 | 26 | 36 | 29 | 21 | 60 | 2.18 | + 0.7 | 2 | 9,821 | s. | 39 | sw. | 9 | 18 | 9 | 4 | 3.7 | 1.6 |
| *Southern Slope.* | | | | | | | **39.4** | **+ 2.0** | | | | | | | | | | **57** | **0.59** | **− 0.2** | | | | | | | | | | **3.2** | |
| Abilene | 1,738 | 45 | 54 | 28.24 | 30.09 | .00 | 43.5 | + 0.7 | 78 | 15 | 56 | 14 | 26 | 31 | 39 | 36 | 29 | 63 | 1.02 | + 0.1 | 1 | 7,468 | s. | 30 | se. | 19 | 20 | 6 | 5 | 3.3 | 0.5 |
| Amarillo | 3,676 | 10 | 49 | 26.24 | 30.07 | + .01 | 35.2 | + 3.3 | 68 | 18 | 49 | 9 | 26 | 21 | 43 | 26 | 15 | 51 | 0.16 | − 0.5 | 2 | 7,391 | nw. | 38 | nw. | 2 | 20 | 11 | 0 | 3.1 | 1.5 |
| *Southern Plateau.* | | | | | | | **40.5** | **− 0.1** | | | | | | | | | | **42** | **0.16** | **− 1.0** | | | | | | | | | | **1.8** | |
| El Paso | 3,762 | 10 | 110 | 26.22 | 30.06 | + .05 | 43.2 | − 1.3 | 70 | 15 | 58 | 16 | 29 | 28 | 43 | 31 | 14 | 36 | T. | − 0.5 | 0 | 7,747 | nw. | 48 | w. | 21 | 26 | 4 | 1 | 1.5 | |
| Santa Fe | 7,013 | 47 | 50 | 23.20 | 30.12 | + .08 | 27.4 | − 0.5 | 54 | 14 | 37 | 3 | 28 | 17 | 28 | 20 | 8 | 47 | 0.20 | − 0.4 | 4 | 5,409 | nw. | 28 | nw. | 10 | 25 | 6 | 0 | 1.5 | 2.1 |
| Flagstaff | 6,907 | 12 | 25 | 23.34 | 30.09 | + .04 | 27.4 | − 1.4 | 56 | 14 | 42 | − 2 | 21 | 13 | 42 | 22 | 17 | 70 | 0.67 | − 3.0 | 2 | 5,619 | nw. | 32 | sw. | 18 | 23 | 4 | 4 | 2.1 | 6.9 |
| Phoenix | 1,108 | 50 | 56 | 28.92 | 30.10 | + .07 | 48.4 | − 1.4 | 79 | 13 | 64 | 25 | 22 | 32 | 38 | 38 | 22 | 39 | 0.11 | − 0.7 | 1 | 2,769 | e. | 27 | ne. | 28 | 26 | 3 | 2 | 1.6 | T. |
| Yuma | 141 | 16 | 46 | 29.95 | 30.10 | + .05 | 54.2 | 0.0 | 76 | 16 | 68 | 32 | * | 41 | 42 | 41 | 22 | 32 | 0.00 | − 0.4 | 0 | 5,104 | n. | 30 | n. | 7 | 29 | 1 | 1 | 0.7 | |
| Independence | 3,910 | 51 | 58 | 26.10 | 30.14 | + .07 | 42.4 | + 4.0 | 66 | 30 | 54 | 21 | 4 | 31 | 33 | 32 | 14 | 31 | T. | − 1.2 | 0 | 6,401 | nw. | 35 | nw. | 22 | 18 | 7 | 6 | 3.5 | |
| *Middle Plateau.* | | | | | | | **27.6** | **− 0.3** | | | | | | | | | | **68** | **0.70** | **− 0.7** | | | | | | | | | | **3.9** | |
| Carson City | 4,720 | 82 | 92 | 25.42 | 30.28 | + .15 | 31.3 | − 1.0 | 58 | 31 | 45 | 0 | 20 | 18 | 46 | 27 | 23 | 73 | 0.46 | − 2.1 | 5 | 3,784 | s. | 52 | w. | 10 | 20 | 6 | 5 | 2.8 | 6.6 |
| Winnemucca | 4,344 | 59 | 70 | 25.76 | 30.29 | + .13 | 27.8 | + 0.8 | 51 | 31 | 40 | 1 | 20 | 16 | 40 | 25 | 20 | 72 | 0.58 | − 0.5 | 6 | 6,439 | sw. | 37 | nw. | 10 | 15 | 10 | 6 | 3.7 | 4.6 |
| Modena | 5,479 | 10 | 43 | 24.69 | 30.21 | + .11 | 25.4 | ... | 59 | 14 | 40 | − 8 | 21 | 11 | 50 | 20 | 13 | 61 | 0.20 | ... | 3 | 6,846 | w. | 55 | sw. | 10 | 19 | 8 | 4 | 2.9 | 2.8 |
| Salt Lake City | 4,366 | 105 | 110 | 25.74 | 30.25 | + .10 | 26.0 | − 1.9 | 48 | 17 | 34 | 7 | 21 | 18 | 23 | 23 | 19 | 75 | 1.45 | 0.0 | 12 | 3,074 | se. | 40 | nw. | 10 | 8 | 10 | 13 | 5.8 | 15.8 |
| Grand Junction | 4,608 | 43 | 48 | 25.46 | 30.15 | + .09 | 25.4 | − 1.6 | 52 | 18 | 37 | 3 | 25 | 14 | 35 | 21 | 14 | 61 | 0.33 | − 0.3 | 7 | 2,756 | se. | 26 | sw. | 18 | 9 | 18 | 4 | 4.7 | 4.7 |
| *Northern Plateau.* | | | | | | | **32.2** | **+ 5.6** | | | | | | | | | | **78** | **1.06** | **− 1.0** | | | | | | | | | | **6.9** | |
| Baker City | 3,471 | 53 | 59 | 26.57 | 30.26 | + .10 | 26.0 | + 3.2 | 46 | 16 | 33 | 0 | 20 | 19 | 30 | 24 | 20 | 78 | 0.65 | − 1.0 | 8 | 4,075 | se. | 36 | sw. | 16 | 3 | 13 | 15 | 7.0 | 6.5 |
| Boise | 2,739 | 61 | 68 | 27.35 | 30.30 | + .11 | 32.7 | + 5.3 | 54 | 17 | 40 | 13 | 20 | 25 | 24 | 29 | 25 | 76 | 0.83 | − 1.5 | 12 | 2,779 | se. | 21 | se. | 10 | 6 | 13 | 12 | 6.2 | 5.6 |
| Lewiston | 757 | 52 | 61 | 29.35 | 30.18 | + .02 | 37.1 | + 1.9 | 53 | 10 | 42 | 19 | 20 | 32 | 20 | ... | ... | ... | 0.59 | − 0.6 | 9 | 2,799 | e. | 29 | w. | 24 | 4 | 11 | 16 | 7.1 | 3.2 |
| Pocatello | 4,482 | 46 | 54 | 25.56 | 30.24 | + .04 | 25.6 | + 6.5 | 49 | 17 | 33 | 2 | 25 | 18 | 31 | 23 | 18 | 68 | 0.87 | − 1.2 | 9 | 7,915 | e. | 36 | sw. | 18 | 5 | 16 | 10 | 6.0 | 12.4 |
| Spokane | 1,929 | 101 | 110 | 28.06 | 30.17 | + .05 | 32.6 | + 8.1 | 49 | 17 | 37 | 17 | 20 | 28 | 16 | 31 | 28 | 84 | 1.31 | − 1.2 | 12 | 5,037 | s. | 36 | s. | 13 | 0 | 4 | 27 | 8.9 | 8.1 |
| Walla Walla | 1,000 | 65 | 71 | 29.10 | 30.19 | + .04 | 39.0 | + 8.5 | 60 | 12 | 45 | 17 | 20 | 34 | 19 | 37 | 34 | 85 | 2.13 | − 0.3 | 11 | 4,578 | s. | 26 | se. | 8 | 4 | 16 | 11 | 6.3 | 9.4 |
| *N. Pac. Coast Reg.* | | | | | | | **41.6** | **+ 2.4** | | | | | | | | | | **87** | **6.17** | **− 1.3** | | | | | | | | | | **8.5** | |
| North Head | 211 | 11 | 56 | 29.96 | 30.19 | + .14 | 43.2 | + 2.3 | 52 | 16 | 47 | 32 | 19 | 39 | 16 | 42 | 41 | 90 | 6.92 | − 1.6 | 26 | 13,941 | se. | 78 | se. | 9 | 2 | 4 | 25 | 8.6 | 3.1 |
| Port Crescent | 259 | 12 | 29 | 29.84 | 30.13 | + .14 | 39.5 | + 4.0 | 59 | 12 | 44 | 26 | 20 | 35 | 23 | ... | ... | ... | 5.57 | − 1.5 | 17 | 3,903 | sw. | 28 | s. | 12 | 1 | 11 | 19 | 7.8 | 3.1 |
| Seattle | 123 | 114 | 151 | 30.06 | 30.20 | + .15 | 41.8 | + 1.0 | 55 | 12 | 45 | 29 | 20 | 38 | 16 | 40 | 38 | 84 | 4.26 | − 0.3 | 21 | 6,467 | se. | 44 | se. | 8 | 1 | 7 | 23 | 8.3 | 2.1 |
| Tacoma | 213 | 113 | 120 | 29.96 | 30.19 | + .15 | 41.0 | + 3.0 | 55 | 13 | 45 | 26 | 20 | 37 | 15 | ... | ... | ... | 6.39 | 0.0 | 19 | 5,249 | sw. | 35 | sw. | 8 | 1 | 6 | 24 | 8.5 | 5.5 |
| Tatoosh Island | 86 | 7 | 57 | 30.01 | 30.11 | + .13 | 42.6 | + 2.0 | 51 | 12 | 46 | 32 | 20 | 39 | 15 | 41 | 40 | 89 | 11.05 | − 1.7 | 25 | 14,532 | sw. | 71 | s. | 12 | 0 | 2 | 29 | 9.5 | T. |
| Portland, Oreg | 154 | 68 | 96 | 30.06 | 30.23 | + .15 | 42.1 | + 3.7 | 58 | 12 | 46 | 30 | 20 | 38 | 16 | 40 | 38 | 87 | 5.22 | − 1.9 | 22 | 4,323 | se. | 26 | sw. | 16 | 1 | 3 | 27 | 8.9 | 0.9 |
| Roseburg | 518 | 56 | 67 | 29.71 | 30.29 | + .19 | 41.3 | + 1.0 | 61 | 12 | 46 | 28 | 25 | 36 | 20 | 39 | 37 | 87 | 3.81 | − 2.4 | 19 | 2,240 | e. | 30 | w. | 17 | 3 | 6 | 22 | 8.2 | T. |
| *Mid. Pac. Coast Reg.* | | | | | | | **48.0** | **+ 1.0** | | | | | | | | | | **74** | **1.78** | **− 3.6** | | | | | | | | | | **3.7** | |
| Eureka | 62 | 62 | 80 | 30.21 | 30.28 | + .18 | 46.3 | + 0.3 | 59 | 15 | 52 | 32 | 20 | 40 | 22 | 44 | 41 | 84 | 5.24 | − 2.4 | 12 | 3,944 | se. | 34 | n. | 24 | 12 | 7 | 12 | 5.1 | |
| Mount Tamalpais | 2,375 | 11 | 18 | 27.71 | 30.22 | + .11 | 45.4 | ... | 60 | 30 | 50 | 29 | 20 | 41 | 16 | 40 | 32 | 64 | 2.42 | ... | 7 | 16,300 | nw. | 70 | nw. | 8 | 21 | 4 | 6 | 3.2 | T. |
| Red Bluff | 332 | 50 | 56 | 29.87 | 30.24 | + .12 | 47.2 | + 2.3 | 72 | 30 | 57 | 30 | 19 | 37 | 33 | 42 | 35 | 68 | 1.44 | − 3.2 | 6 | 4,477 | n. | 26 | n. | 24 | 20 | 6 | 5 | 2.8 | |
| Sacramento | 69 | 106 | 117 | 30.16 | 30.23 | + .11 | 45.6 | 0.0 | 62 | 30 | 54 | 32 | 21 | 38 | 25 | 42 | 39 | 79 | 0.45 | − 3.4 | 6 | 4,745 | se. | 26 | se. | 17 | 16 | 9 | 6 | 3.5 | |
| San Francisco | 155 | 161 | 167 | 30.08 | 30.26 | + .15 | 50.6 | + 0.5 | 65 | 27 | 56 | 40 | 21 | 45 | 20 | 46 | 42 | 75 | 1.05 | − 3.7 | 5 | 4,292 | n. | 26 | w. | 17 | 17 | 9 | 5 | 3.3 | |
| Point Reyes Light | 490 | 7 | 50 | ... | ... | ... | 50.4 | + 1.8 | 62 | 29 | 55 | 38 | 20 | 46 | 17 | ... | ... | ... | 0.73 | − 5.3 | 5 | 14,001 | nw. | 62 | nw. | 4 | 14 | 5 | 12 | 4.5 | |
| Southeast Farallon | 30 | 9 | 17 | 30.20 | 30.23 | ... | 51.2 | ... | 57 | 7 | 54 | 44 | 19 | 49 | 10 | ... | ... | ... | 0.88 | ... | 7 | 12,117 | nw. | 48 | nw. | 5 | 14 | 8 | 9 | 4.3 | |
| *S. Pac. Coast Reg.* | | | | | | | **52.2** | **+ 1.6** | | | | | | | | | | **59** | **0.46** | **− 2.3** | | | | | | | | | | **2.4** | |
| Fresno | 330 | 67 | 70 | 29.84 | 30.23 | + .13 | 44.6 | + 0.1 | 70 | 31 | 55 | 28 | 20 | 34 | 31 | 40 | 35 | 74 | 0.57 | − 0.8 | 5 | 2,649 | nw. | 24 | nw. | 17 | 17 | 7 | 7 | 3.6 | |
| Los Angeles | 338 | 116 | 123 | 29.76 | 30.13 | + .05 | 55.8 | + 2.7 | 85 | 13 | 68 | 35 | 19 | 43 | 39 | 46 | 35 | 51 | 0.14 | − 2.8 | 1 | 3,924 | ne. | 20 | sw. | 18 | 22 | 7 | 2 | 2.0 | |
| San Diego | 87 | 94 | 102 | 30.01 | 30.11 | + .04 | 55.7 | + 2.1 | 83 | 13 | 65 | 36 | 21 | 47 | 28 | 47 | 38 | 58 | 0.04 | − 2.0 | 2 | 4,310 | ne. | 27 | nw. | 20 | 26 | 5 | 0 | 1.9 | |
| San Luis Obispo | 201 | 46 | 48 | 29.96 | 30.18 | + .09 | 52.6 | + 1.5 | 82 | 13 | 64 | 30 | 8 | 41 | 42 | 44 | 35 | 54 | 1.08 | − 3.6 | 3 | 4,324 | n. | 23 | n. | 12 | 26 | 2 | 3 | 1.9 | |
| *West Indies.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Basseterre | 29 | 41 | 54 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Bridgetown | 30 | 57 | 65 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Cienfuegos | 52 | 62 | 67 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Grand Turk | 11 | 6 | 20 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Hamilton | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Havana | 286 | 41 | 62 | 30.00 | 30.05 | .00 | 70.2 | − 0.1 | 84 | 29 | 76 | 56 | 10 | 64 | 22 | ... | ... | ... | 2.03 | − 0.7 | 7 | 8,282 | e. | 48 | ne. | 19 | 14 | 10 | 7 | 4.1 | |
| Puerto Principe | 352 | 55 | 90 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| San Juan | 82 | 48 | 52 | 29.93 | 30.02 | .00 | 75.4 | + 0.1 | 84 | 8 | 81 | 67 | 20 | 70 | 14 | 70 | 68 | 79 | 4.07 | + 1.1 | 22 | 7,794 | e. | 38 | ne. | 20 | 15 | 13 | 3 | 4.0 | |

* More than one date.

TABLE II.—*Climatological record of voluntary and other cooperating observers, January, 1904.*

| Stations. | Temperature. (Fahrenheit.) | | | Precipitation. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Rain and melted snow. | Total depth of snow. |
| *Alabama.* | ° | ° | ° | *Ins.* | *Ins.* |
| Anniston | | | | 4.14 | 10.0 |
| Ashville | 65 | 12 | 38.6 | 6.31 | 7.0 |
| Benton | | | | 5.30 | |
| Bridgeport | | | | 2.36 | 3.5 |
| Burkeville | | | | 4.50 | |
| Calera | | | | 6.40 | 10.0 |
| Citronelle | 70 | 24 | 49.0 | 4.58 | |
| Clanton | 64 | 19 | 44.0 | 5.08 | 4.0 |
| Cordova | 66 | 12 | 41.0 | 4.30 | 5.5 |
| Decatur | 65 | 14 | 38.4 | 1.90 | 2.5 |
| Demopolis | | | | 4.92 | 4.0 |
| Dothan | 69 | 23 | 47.3 | 5.41 | |
| Eufaula | 67 | 21 | 41.8 | 5.07 | |
| Evergreen | 69 | 23 | 46.0 | 4.05 | |
| Flomaton | 73 | 18 | 46.2 | 4.95 | |
| Florence *a* | | | | 2.96 | 2.8 |
| Florence *b* | 65 | 12 | 38.9 | 2.94 | 3.8 |
| Fort Deposit | 67 | 21 | 43.4 | 3.74 | |
| Gadsden | 64 | 15 | 38.4 | 4.22 | 5.0 |
| Goodwater | 63 | 15 | 39.5 | 6.17 | 4.8 |
| Greensboro | 67 | 19 | 42.4 | 5.08 | 6.0 |
| Greenville | | | | 2.85 | |
| Haleysville *b* | 70 | 10 | 42.2 | 2.01 | 2.1 |
| Hamilton | 67 | 11 | 39.0 | 3.60 | 4.6 |
| Highland Home | 66 | 21 | 45.4 | 4.88 | T. |
| Letohatchie | | | | 3.73 | |
| Livingston | 68 | 17 | 45.3 | 4.26 | |
| Lock No. 4 | 64 | 15 | 40.4 | 3.85 | 6.0 |
| Madison Station | 65 | 13 | 41.1 | 3.22 | 2.0 |
| Maplegrove | 65 | 13 | 36.2 | 3.89 | 6.5 |
| Marion | 66 | 19 | 41.2 | 5.82 | 4.5 |
| Milstead | | | | 4.22 | |
| Newbern | 66 | 18 | 42.2 | 5.51 | 3.0 |
| Notasulga | | | | 3.04 | |
| Oneonta | 63 | 14 | 38.8 | 3.85 | 6.0 |
| Opelika | 65 | 17 | 39.6 | 5.48 | 1.3 |
| Ozark | 68 | 22 | 43.9 | 2.55 | |
| Prattville | 67 | 19 | 42.8 | 5.17 | T. |
| Pushmataha | 68 | 17 | 43.8 | 4.09 | 3.0 |
| Riverton | 65 | 9 | 38.8 | 3.03 | 1.6 |
| Selma | 68 | 22 | 46.4 | 6.14 | 2.9 |
| Spring Hill | 68 | 26 | 49.7 | | |
| Talladega | 64 | 13 | 41.4 | 4.53 | 10.0 |
| Tallassee | | | | 4.39 | |
| Thomasville | 69 | 20 | 42.8 | 4.83 | 2.0 |
| Tuscaloosa | 66 | 16 | 39.1 | 4.41 | 8.0 |
| Tuscumbia | 65 | 13 | 38.2 | 2.73 | 1.4 |
| Tuskegee | 66 | 20 | 44.4 | 5.50 | T. |
| Union Springs | 68 | 22 | 43.0 | 5.19 | |
| Uniontown | 70 | 16 | 42.7 | 4.82 | T. |
| Valleyhead | 62 | 12 | 38.0 | 4.37 | 3.0 |
| Verbena | | | | 2.80 | |
| Wetumpka | 67 | 21 | 44.8 | 4.50 | |
| *Alaska.* | | | | | |
| Copper Center | 42 | −55 | −12.4 | 0.67 | 8.2 |
| Fort Liscum | 42 | −7 | 22.6 | 6.80 | 88.0 |
| Killisnoo | 47 | 3 | 28.0 | 4.30 | 22.5 |
| Orca | 42 | 11 | 27.8 | 11.69 | 12.0 |
| Sitka | 44 | 5 | 30.2 | 9.76 | 6.0 |
| Skagway | 43 | −11 | 20.9 | 1.44 | 5.0 |
| *Arizona.* | | | | | |
| Agua Caliente | 79 | 23 | 49.5 | 0.00 | |
| Allaire Ranch | | | | 0.32 | T. |
| Arizona Canal Co's Dam | 79c | 25c | 52.0c | 0.40 | |
| Aztec | 77 | 22 | 48.4 | T. | |
| Benson | | | | 0.05 | |
| Bisbee | 71e | 18e | 46.0e | 0.12 | 1.0 |
| Blue | 61 | 4 | 32.2 | 0.20 | 3.5 |
| Bowie | 70 | 12 | 40.3 | 0.02 | 0.2 |
| Casagrande | 77 | 21 | 47.3 | 0.14 | |
| Champie Camp | 82 | 13 | 46.6 | 0.06 | T. |
| Cochise *1 | 65 | 18 | 46.0 | 0.40 | 1.0 |
| Congress | 73 | 27 | 50.4 | T. | T. |
| Douglas | 69 | 10 | 39.8 | 0.02 | 0.2 |
| Dragoon *1 | 65 | 24 | 38.5 | 0.10 | 1.0 |
| Dudleyville | 75 | 16 | 43.7 | 0.39 | T. |
| Duncan | 70 | 4 | 35.8 | T. | T. |
| Fort Apache | 67 | 2 | 34.4 | 0.80 | 8.0 |
| Fort Defiance | 52 | −7 | 22.8 | 0.00 | |
| Fort Grant | 71 | 12 | 44.8 | 0.51 | 0.5 |
| Fort Huachuca | 70 | 21 | 45.0 | 0.15 | 1.0 |
| Fort Mohave | 75 | 27 | 49.6 | 0.00 | |
| Gilabend | 76 | 23 | 52.0 | 0.00 | |
| Grand Canyon | 55 | 22 | 36.6 | 0.60 | 6.0 |
| Greaterville | 71 | 8 | 43.0 | 0.10 | 2.0 |
| Holbrook | 64 | −2 | 29.9 | 0.19 | 2.5 |
| Jerome | 63 | 17 | 40.4 | 0.02 | 0.2 |
| Kingman | 68 | 18 | 40.6 | T. | T. |
| Maricopa | 70 | 17 | 44.7 | T. | |
| Mesa | 81 | 18 | 47.8 | 0.29 | |
| Mesa (near) | 68 | 18 | 41.7 | 0.10 | |
| Natural Bridge | | | | 0.46 | 6.0 |
| Nogales | 77 | 14 | 43.5 | 0.17 | T. |
| Oracle | 67 | 31 | 45.6 | 0.18 | 1.5 |
| Oro | | | | 0.12 | |
| Parker | 80 | 19 | 48.4 | 0.00 | |
| Phoenix | 79 | 19 | 46.7 | 0.15 | |
| Pinal Ranch | | | | 0.47 | 3.5 |
| *Arizona*—Cont'd. | | | | | |
| Prescott | 65 | 1 | 31.4 | 0.35 | 3.5 |
| San Carlos | 72 | 12 | 41.6 | 0.25 | T. |
| San Simon | 70 | 10 | 39.3 | 0.10 | 1.0 |
| Sentinel *5 | 76 | 30 | 53.9 | 0.00 | |
| Signal | 80 | 16 | 46.4 | T. | |
| Superstition | | | | 0.30 | |
| Taylor | 60 | 0 | 27.9 | 0.11 | 1.1 |
| Thatcher | 71 | 13 | 40.4 | 0.10 | T. |
| Tombstone | 84 | 19 | 53.0 | 0.04 | |
| Tonto | 69 | 22 | 44.2 | 0.09 | T. |
| Tucson | 79 | 15 | 45.4 | 0.20 | |
| Upper San Pedro | 74 | 9 | 39.7 | 0.40 | 0.4 |
| Vail *5 | 78 | 24 | 52.8 | | |
| Walnutgrove | | | | 0.02 | |
| Wilcox | 67 | 8 | 37.1 | 0.10 | 0.4 |
| Williams | 66 | −5 | 30.0 | 0.50 | 5.0 |
| Yarnell | | | | 0.18 | 2.0 |
| Young | 72 | 0 | 36.0 | 0.55 | 6.5 |
| *Arkansas.* | | | | | |
| Alco | 65 | 0 | 37.0 | 5.36 | 7.0 |
| Amity | 73 | 7 | 40.6 | 2.72 | T. |
| Arkadelphia | 70 | 10 | 42.2 | 3.83 | |
| Arkansas City | | | | 2.95 | |
| Batesville | 63 | 3 | 37.7 | 4.22 | |
| Beebranch | 68f | 3g | 41.2f | 5.00 | |
| Blanchard | 72 | 13 | 42.7 | 2.23 | |
| Brinkley | 67 | 8 | 40.0 | 2.11 | 0.5 |
| Camden *a* | | | | 3.19 | |
| Conway | 67 | 8 | 40.2 | 3.24 | |
| Corning | 64 | 2 | 34.8 | 4.56 | 0.8 |
| Dallas | 67 | 5 | 40.3 | 3.81 | 2.5 |
| Dardanelle | | | | 2.42 | |
| Des Arc | 69 | 8 | 42.5 | 3.14 | T. |
| Dodd City | 66 | −2 | 34.6 | 5.65 | 6.5 |
| Dutton | 60 | −4 | 34.6 | 4.33 | 3.5 |
| Elon | 70g | 14g | 40.9g | 3.48 | |
| Eureka Springs | 68 | −4 | 35.6 | 4.26 | 4.2 |
| Fayetteville | 66e | −4e | 34.8e | 3.22 | 4.0 |
| Forrest City | 64 | 5 | 37.4 | 3.30 | 2.0 |
| Fulton | | | | 3.58 | |
| Hardy | 66 | 1 | 37.2 | 3.89 | 1.5 |
| Heber | 67 | 5 | 38.4 | 5.41 | 0.5 |
| Helena *a* | | | | 3.60 | |
| Helena *b* | 66 | 9 | 40.4 | 3.46 | |
| Jonesboro | 69 | 1 | 40.8 | 5.53 | 0.5 |
| Lake Village | 69 | 17 | 42.6 | 4.28 | |
| Lutherville | 67 | 3 | 35.6 | 5.16 | 5.0 |
| Malvern | 70 | 10 | 40.0 | 3.60 | T. |
| Marvell | 66 | 9 | 41.4 | 2.68 | T. |
| Mossville | 58 | 6 | 35.2 | 5.47 | 5.4 |
| Mount Nebo | 62 | 0 | 37.2 | 3.66 | 3.0 |
| New Gascony | 67d | 10e | 40.6d | 3.05 | 0.5 |
| Newport *a* | | | | 5.84 | |
| Newport *b* | 68 | 6 | 37.1 | 5.71 | |
| Oregon | 65 | −5 | 34.0 | 3.82 | 5.4 |
| Ozark | 63 | 3 | 36.4 | 3.60 | 4.0 |
| Paragould | 67 | 3 | 38.1 | 3.75 | 0.5 |
| Perry | 69 | 8 | 40.4 | 2.50 | 0.5 |
| Pinebluff | 69 | 12 | 39.3 | 4.28 | |
| Pocahontas | 67 | 2 | 36.8 | 4.89 | 2.5 |
| Pond | 66 | −4 | 34.8 | 6.56 | 1.5 |
| Prescott | 75 | 10 | 41.3 | 3.89 | |
| Princeton | 68 | 10 | 42.0 | 3.30 | |
| Posadale | 72 | 9 | 43.0 | 2.34 | 1.0 |
| Russellville | 65 | 8 | 32.3 | 4.18 | 1.0 |
| Silversprings | 66 | −4 | 35.6 | 3.55 | 3.0 |
| Spielerville | 69 | 5 | 39.0 | 4.60 | 4.0 |
| Stuttgart | 67 | 6 | 40.2 | 2.75 | T. |
| Texarkana | 72 | 10 | 45.5 | 2.08 | |
| Warren | 69 | 11 | 41.4 | 3.12 | |
| Washington | 72 | 11 | 44.4 | 2.56 | |
| Wiggs | 69 | 6 | 40.2 | 3.29 | T. |
| Winslow | 60 | −4 | 33.2 | 2.79 | 6.0 |
| Witts Springs | 64b | 3b | 32.4b | 5.95 | 7.0 |
| *California.* | | | | | |
| Angiola | 75 | 24 | 46.2 | 0.60 | |
| Azusa | 86 | 26 | 53.9 | 0.15 | |
| Bagdad | 74 | 33 | 51.2 | 0.00 | |
| Bakersfield | 74 | 22 | 44.2 | 0.32 | |
| Barstow | 71 | 30 | 50.1 | T. | |
| Bear Valley | | | | 4.46 | 34.0 |
| Berkeley | 60 | 32 | 46.9 | 1.40 | |
| Bishop | 72 | 14 | 39.9 | T. | |
| Boca *1 | 48 | 0 | 20.3 | 1.20 | 12.0 |
| Bodie | 61 | −14 | 24.3 | 0.20 | 2.0 |
| Bowman | | | | 5.37 | 33.5 |
| Branscomb | 72 | 22 | 44.4 | 8.61 | 6.0 |
| Brush Creek | 63 | 20 | 39.7 | 4.81 | 4.0 |
| Butte Valley | | | | 4.20 | 38.0 |
| Calabasas | | | | 0.40 | |
| Campbell | 67 | 28 | 46.3 | 0.77 | |
| Campo | | | | 0.41 | |
| Cedarville | 50 | 3 | 29.0 | 1.12 | 9.5 |
| Chico | 66 | 27 | 45.6 | 0.80 | |
| Chino | 80 | 20 | 51.3 | 0.17 | |
| Cisco *1 | 49 | 4 | 31.0 | 5.20 | 45.0 |
| Claremont | 85 | 30 | 52.2 | 0.36 | |
| Cloverdale | 71 | 29 | 48.6 | 2.13 | |
| *California*—Cont'd. | | | | | |
| Coachella | 85 | 24 | 54.8 | 0.00 | |
| Colusa | 66 | 31 | 46.0 | 0.66 | |
| Corning *5 | 66 | 32 | 47.7 | 0.60 | |
| Coronado | | | | 0.20 | |
| Craftonville | | | | 0.66 | |
| Crescent City | 61 | 31 | 45.0 | 7.61 | |
| Crockers | | | | 1.87 | 17.0 |
| Cuyamaca | 56 | 13 | 36.0 | 0.78 | 3.0 |
| Delano *1 | 67 | 27 | 43.1 | 0.20 | |
| Delta | 73 | 24 | 45.5 | 3.96 | 2.0 |
| Dobbins | 72 | 29 | 50.7 | 3.79 | 2.0 |
| Drytown | 62 | 25 | 43.8 | 2.52 | |
| Dunnigan *1 | 65 | 32 | 48.6 | 0.66 | |
| Durham | 58 | 30 | 43.0 | 1.70 | |
| Elcajon | 88 | 28 | 53.0 | 0.17 | |
| Electra | | | | 2.61 | |
| Elmdale | 70 | 32 | 49.7 | 0.57 | |
| Elsinore | 87 | 21 | 49.0 | 0.19 | |
| Escondido | 82 | 18 | 45.9 | 0.41 | |
| Fallbrook | 84 | 26 | 52.1 | 0.48 | |
| Folsom City | | | | 1.12 | |
| Fort Bragg | | | | 4.91 | |
| Fort Ross | 58 | 34 | 46.8 | 2.37 | |
| Foster | | | | 0.41 | |
| Fouts Springs | | | | 2.34 | |
| Georgetown | 68 | 18 | 43.8 | 4.79 | 12.0 |
| Gilroy (near) | 74 | 22 | 46.0 | 0.90 | |
| Greenville | 55 | 1 | 30.8 | 2.39 | 20.0 |
| Hanford | 75 | 20 | 43.0 | 0.52 | |
| Healdsburg | 74 | 27 | 47.9 | 2.01 | |
| Highland Springs | | | | 2.14 | 0.6 |
| Hollister | 73 | 25 | 46.3 | 0.73 | |
| Idylwild | 71 | 9 | 40.3 | 0.80 | 8.0 |
| Imperial | 78 | 28 | 52.5 | 0.00 | |
| Iowa Hill *1 | 65 | 24 | 45.5 | 4.58 | 12.5 |
| Irvine | | | | 0.26 | |
| Isabella | 72 | 18 | 44.4 | 0.40 | |
| Jamestown | 61 | 19 | 42.2 | 1.96 | |
| Jolon | | | | 0.70 | |
| Kennedy Gold Mine | | | | 2.08 | 2.0 |
| Kentfield | | | | 2.05 | |
| Kernville | | | | 0.20 | |
| King City | 80 | 18 | 47.3 | 0.51 | |
| Laguna Valley | | | | 0.55 | 5.0 |
| Lamesa | | | | 0.12 | |
| Lakeport (near) | 54 | 30 | 44.0 | 1.40 | |
| Laporte | 53 | 6 | 33.5 | 4.48 | 37.2 |
| Legrande | 69 | 24 | 47.6 | 1.15 | |
| Lemoncove | 74 | 22 | 46.4 | 0.83 | |
| Lick Observatory | 63 | 19 | 41.4 | 1.98 | 7.0 |
| Livermore | 70 | 27 | 47.2 | 0.89 | |
| Lodi | 60 | 27 | 42.9 | 0.72 | |
| Lordsburg | | | | 0.36 | |
| Los Gatos | 63 | 31 | 46.9 | 1.29 | |
| Magnolia | 64 | 20 | 45.2 | 3.43 | 0.5 |
| Mammoth | 77 | 29 | 53.3 | 0.00 | |
| Meadow Valley | | | | 4.13 | 24.0 |
| Merced | 70 | 20 | 45.1 | 0.55 | |
| Mercury | | | | 2.13 | |
| Mills College | | | | 1.97 | |
| Milo | | | | 1.02 | |
| Milton (near) | 61 | 30 | 45.0 | 0.93 | |
| Modesto *1 | 71 | 32 | 53.2 | 0.33 | |
| Mohave | 71 | 23 | 46.4 | 0.00 | |
| Mokelumne Hill | | | | 2.44 | 2.0 |
| Montague | 53 | 15 | 33.3 | 1.13 | T. |
| Monterio | 76 | 22 | 46.8 | 0.94 | |
| Monterey *1 | 62 | 32 | 47.3 | 1.17 | |
| Mount St. Helena | | | | 3.37 | T. |
| Napa | 66 | 29 | 45.4 | 0.92 | |
| Needles | 80 | 35 | 54.8 | 0.00 | |
| Nellie | | | | 1.42 | 4.0 |
| Nevada City | 70 | 10 | 42.7 | 2.76 | 10.0 |
| Newcastle | 68 | 28 | 47.2 | 1.93 | |
| Newman | 68 | 24 | 43.4 | 0.23 | |
| Niles | 66 | 30 | 48.0 | 1.33 | |
| Nimshew | 64 | 20 | 43.6 | 2.81 | 2.4 |
| North Bloomfield | 71 | 13 | 42.2 | 3.85 | 10.0 |
| Nordhoff | | | | 0.89 | |
| Oakland | 63 | 33 | 48.8 | 1.31 | |
| Ontario (near) | 82 | 27 | 51.1 | 0.27 | |
| Orland | 66 | 30 | 48.7 | 0.72 | |
| Orleans | 67 | 28 | 46.1 | 6.39 | |
| Oroville (near) | 70 | 28 | 45.4 | 1.60 | |
| Palermo | 69 | 26 | 44.9 | 1.48 | |
| Paso Robles | 71 | 18 | 43.9 | 0.44 | |
| Peachland *5 | 64 | 28 | 46.4 | 2.44 | |
| Pilot Creek | | | | 5.48 | 32.5 |
| Pine Crest | 81 | 33 | 56.6 | 0.77 | |
| Pino Grande | 65 | 12 | 39.7 | 5.39 | 25.0 |
| Placerville | 60 | 14 | 40.8 | 2.96 | 4.5 |
| Priest Valley | | | | 0.74 | 2.0 |
| Point Lobos | 60 | 40 | 49.4 | 0.76 | |
| Porterville | 75 | 25 | 45.5 | 0.53 | |
| Poway | | | | 0.47 | |
| Quincy | 48 | 5 | 30.3 | 2.46 | 17.5 |
| Redding | 72 | 30 | 48.0 | 2.34 | |
| Redlands | 78 | 30 | 51.2 | 0.29 | |

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

| Stations. | Temperature. (Fahrenheit.) Maximum. | Minimum. | Mean. | Precipitation. Rain and melted snow. | Total depth of snow. |
|---|---|---|---|---|---|
| *California*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Reedley | 69 | 30 | 47.6 | 0.81 | |
| Represa | 58 | 28 | 45.7 | 1.15 | |
| Riovista | 63 | 26 | 44.2 | 0.44 | |
| Riverside | 83 | 27 | 50.0 | 0.15 | |
| Rohnerville | ..... | ..... | ..... | 5.87 | |
| Rosewood | 71 | 23 | 43.0 | 1.42 | |
| Sacramento | 61 | 29 | 44.3 | 0.63 | |
| Salinas | 73 | 28 | 48.4 | 0.92 | |
| Salton | 78 | 27 | 51.8 | 0.00 | |
| San Bernardino | 86 | 25 | 51.4 | 0.18 | |
| San Jose | 68 | 29 | 46.8 | 1.28 | |
| San Leandro | 63 | 31 | 46.6 | 1.39 | |
| San Mateo | 69 | 33 | 49.6 | 1.42 | |
| San Miguel*[1] | 69 | 19 | 43.7 | 0.52 | |
| San Miguel Island | 78 | 45 | 56.2 | 0.00 | |
| San Rafael | 66 | 31 | 47.6 | 1.33 | |
| Santa Barbara | 82 | 33 | 55.0 | 0.46 | |
| Santa Clara College | 69 | 26 | 47.1 | 1.03 | |
| Santa Cruz | 70 | 27 | 47.3 | 1.85 | |
| Santa Maria | 78 | 30 | 52.0 | 0.55 | |
| Santa Monica | 85 | 36 | 55.6 | 0.11 | |
| Santa Rosa | 68 | 26 | 45.2 | 1.77 | |
| Sausalito | ..... | ..... | ..... | 1.67 | |
| Shasta | 74 | 29 | 47.4 | 2.79 | |
| Sierra Madre | 80 | 35 | 55.0 | 0.43 | |
| Sisson | 61 | 10 | 32.8 | 3.26 | 13.0 |
| Snedden | ..... | ..... | ..... | 0.50 | |
| Sonoma | ..... | ..... | ..... | 1.88 | |
| Sonora | 60 | 21 | 41.1 | 1.79 | 5.5 |
| Stirling City | 72 | 16 | 42.4 | 3.96 | 12.5 |
| Stockton | 59 | 27 | 42.8 | 0.54 | |
| Storey | 67 | 22 | 43.8 | 0.69 | |
| Summerdale | 67 | 9 | 40.5 | 2.60 | 22.0 |
| Summit | 42 | 6 | 26.8 | 4.20 | 16.0 |
| Susanville | 45 | 0 | 27.2 | 1.25 | 10.0 |
| Tehama*[1] | 62 | 32 | 48.5 | 1.01 | |
| Tejon Ranch | 70 | 31 | 46.4 | 1.25 | |
| Truckee*[1] | ..... | ..... | ..... | 1.91 | 29.5 |
| Tulare *c* | 76 | 22 | 45.0 | 0.56 | |
| Ukiah | 69 | 25 | 44.6 | 2.85 | |
| Upland | 76 | 28 | 49.8 | 0.39 | |
| Upperlake | 71 | 20 | 42.4 | 1.62 | |
| Upper Mattole | ..... | ..... | ..... | 8.14 | 0.2 |
| Vacaville*[1] | 67 | 31 | 46.6 | 1.67 | |
| Ventura | 80 | 33 | 57.2 | 0.40 | |
| Visalia | 75 | 23 | 44.0 | 0.68 | |
| Volcano | 77 | 22 | 50.8 | 0.00 | |
| Wasco | 74 | 24 | 44.6 | 0.40 | |
| Westpoint | ..... | ..... | ..... | 4.62 | 19.0 |
| Wheatland | 61 | 28 | 43.2 | 1.09 | |
| Willits | ..... | ..... | ..... | 4.92 | 1.8 |
| Willow | 67 | 30 | 45.4 | 0.45 | |
| Yosemite | ..... | ..... | ..... | 2.99 | 20.0 |
| Zenia | 71 | 16 | 41.2 | 6.36 | 22.0 |
| *Colorado.* | | | | | |
| Alford | 57 | − 4 | 25.8 | 0.08 | 2.0 |
| Antelope Springs | 50 | −21 | 13.0 | 0.09 | 1.1 |
| Ashcroft | 43 | −16 | 17.6 | 0.66 | 15.5 |
| Blaine | 74 | − 1 | 30.4 | 0.00 | |
| Boulder | 63 | 0 | 32.4 | 0.09 | 2.0 |
| Breckenridge | 45 | −21 | 14.2 | 1.69 | 33.0 |
| Buenavista | ..... | ..... | ..... | 0.00 | |
| Burlington | 66 | − 7 | 27.4 | T. | T. |
| Canyon | 67 | 0 | 32.6 | T. | T. |
| Castlerock | 66 | −10 | 26.4 | 0.16 | 2.5 |
| Cheesman | 64 | −10 | 26.2 | 0.06 | 1.2 |
| Cheyenne Wells | 66 | −11 | 27.0 | T. | T. |
| Clearview | 51 | −17 | 19.8 | 0.36 | 6.5 |
| Collbran | 45 | −10 | 19.5 | 0.80 | 16.7 |
| Colorado Springs | 62 | − 1 | 28.2 | 0.28 | 4.1 |
| Conejos | 45 | −11 | 19.4 | T. | T. |
| Cripplecreek | ..... | ..... | ..... | 0.06 | 1.1 |
| Durango | 55 | − 4 | 24.5 | 0.13 | 1.8 |
| Fort Collins | 65 | − 7 | 26.0 | 0.04 | 0.6 |
| Fort Morgan | 63 | −10 | 25.4 | 0.02 | 0.5 |
| Fowler | ..... | ..... | ..... | 0.21 | 2.7 |
| Fox | 66 | − 2 | 26.6 | T. | T. |
| Fruita | 52 | − 5 | 22.6 | 0.12 | 2.7 |
| Garnett | 47 | −19 | 14.7 | 0.05 | 1.0 |
| Gilman | ..... | ..... | ..... | 2.52 | 39.5 |
| Gleneyre | 65 | − 9 | 26.4 | 0.26 | 2.6 |
| Glenwood | 47 | −15 | 17.6 | 0.81 | ..... |
| Greeley | 65 | − 3 | 27.3 | T. | T. |
| Grover | ..... | ..... | ..... | T. | T. |
| Gunnison | 36 | −30 | 5.8 | 0.29 | 4.9 |
| Hamps | 65 | − 8 | 25.0 | 0.03 | 0.5 |
| Hoehne | 65 | −25 | 25.8 | 0.35 | 5.0 |
| Holly | 74 | − 1 | 31.2 | T. | T. |
| Holyoke (near) | 68 | −10 | 26.2 | 0.02 | 0.5 |
| Husted | 60 | −15 | 22.4 | 0.19 | 3.4 |
| Lake Moraine | 46 | −11 | 18.5 | 0.46 | 5.6 |
| Lamar | 71 | 0 | 31.2 | 0.00 | |
| Laporte | ..... | ..... | ..... | 0.05 | 1.2 |
| Las Animas | ..... | ..... | ..... | 0.00 | |
| Leadville (near) | 42 | −11 | 14.4 | 0.41 | 7.0 |
| Leroy | 65 | − 7 | 27.4 | 0.10 | 1.4 |
| Longs Peak | 45 | 11 | 19.4 | 0.21 | 4.5 |
| Mancos | 57 | − 9 | 22.5 | 0.36 | 4.4 |
| *Colorado*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Marshall Pass | ..... | ..... | ..... | 1.77 | 33.0 |
| Meeker | 50 | −17 | 17.6 | 0.90 | 18.4 |
| Montrose | 48 | − 5 | 22.8 | 0.85 | 10.9 |
| Moraine | 50 | − 8 | 21.9 | T. | T. |
| Pagoda | 50 | −10 | 19.0 | 1.48 | 25.0 |
| Parachute | 46 | − 8 | 21.9 | 0.88 | 14.0 |
| Platte Canon | ..... | ..... | ..... | 0.03 | 0.7 |
| Rangely | 44 | −17 | 11.8 | 0.46 | 7.8 |
| Rockyford | 66 | 0 | 28.9 | T. | T. |
| Rogers Mesa | 54 | 0 | 23.6 | 0.32 | 4.5 |
| Ruby | ..... | ..... | ..... | 2.92 | 49.0 |
| Saguache | 48 | − 8 | 18.7 | 0.02 | 0.5 |
| Salida | 58 | −12 | 23.7 | 0.03 | 0.8 |
| San Luis | 50 | −15 | 19.2 | T. | T. |
| Santa Clara | 54 | − 6 | 24.8 | 0.98 | 14.0 |
| Silt | 48 | − 3 | 22.2 | 1.12 | 13.5 |
| Sugar Loaf | 51 | − 7 | 23.4 | T. | T. |
| Trinidad | 69 | 0 | 30.5 | 0.83 | 12.0 |
| Vilas | ..... | ..... | ..... | T. | T. |
| Wagon Wheel | 57 | −21 | 14.4 | 0.20 | 3.0 |
| Walden | 46 | −14 | 15.7 | 0.17 | 3.5 |
| Wallet | ..... | ..... | ..... | T. | T. |
| Waterdale | 64 | − 5 | 26.9 | 0.02 | 0.3 |
| Westcliffe | 58 | −15 | 21.4 | 0.11 | 1.8 |
| Whitepine | 37 | −24 | 8.2 | 1.19 | 21.9 |
| Wray | 68 | − 7 | 27.6 | T. | 0.2 |
| Yuma | ..... | ..... | ..... | T. | T. |
| *Connecticut.* | | | | | |
| Bridgeport | 48 | −14 | 21.1 | 3.95 | 22.7 |
| Canton | 44 | −26 | 15.0 | 4.32 | 23.5 |
| Colchester | 51 | −16 | 20.0 | 4.90 | 23.0 |
| Falls Village | ..... | ..... | ..... | 2.92 | 21.2 |
| Hartford | 43 | −20 | 17.7 | 4.54 | 28.0 |
| Hawleyville | 52 | −15 | 18.2 | 4.49 | 24.0 |
| Lake Konomoc | ..... | ..... | ..... | 5.16 | ..... |
| New London | 42 | − 6 | 21.4 | 4.98 | 32.5 |
| North Grosvenor Dale | 48 | −25 | 16.0 | 5.48 | ..... |
| Norwalk | 47 | −22 | 18.8 | 3.26 | 18.5 |
| Southington | 46 | −27 | 17.7 | 3.70 | 24.0 |
| South Manchester | ..... | ..... | ..... | 3.82 | 22.0 |
| Storrs | 50 | −11 | 19.0 | 4.55 | 26.4 |
| Voluntown | 51 | −29 | 20.3 | 4.44 | 20.5 |
| Wallingford | ..... | ..... | ..... | 4.91 | 23.5 |
| Waterbury | 48 | −19 | 18.5 | 4.45 | 32.5 |
| West Cornwall | 47 | −15 | 17.3 | 4.69 | 36.2 |
| West Simsbury | ..... | ..... | ..... | 3.53 | 21.0 |
| *Delaware.* | | | | | |
| Delaware City | ..... | ..... | ..... | 2.36 | 15.0 |
| Milford | 63 | 1 | 29.5 | 1.62 | 7.0 |
| Millsboro | 61 | 0 | 30.5 | 1.96 | 7.0 |
| Newark | 55 | −10 | 25.0 | 2.57 | 4.6 |
| Seaford | 62 | 2 | 29.2 | 1.73 | 7.0 |
| *District of Columbia.* | | | | | |
| Distributing Reservoir*[5] | 58 | 2 | 27.4 | 1.47 | ..... |
| Receiving Reservoir*[5] | 57 | − 4 | 26.8 | 1.72 | ..... |
| West Washington | 59 | 2 | 27.7 | 3.19 | 18.3 |
| *Florida.* | | | | | |
| Apalachicola | 76 | 30 | 52.0 | 5.02 | |
| Archer | 82 | 28 | 51.7 | 10.79 | |
| Avon Park | 82 | 34 | 60.6 | 4.09 | |
| Bartow | 81 | 30 | 59.2 | 2.47 | |
| Bonifay | 69 | 22 | 48.8 | 5.60 | |
| Brooksville | 82 | 33 | 57.2 | 5.32 | |
| Carrabelle | 71 | 25 | 51.3 | 3.32 | |
| Clermont | 81 | 34 | 58.3 | 5.73 | |
| De Funiak Springs | 69 | 23 | 47.6 | 5.54 | |
| Deland | 79 | 26 | 55.0 | ..... | |
| Eustis | 80 | 34 | 56.6 | 5.93 | |
| Federal Point | 79 | 29 | 53.3 | 6.95 | |
| Fernandino | 78 | 30 | 49.8 | 7.50 | |
| Flamingo | 81 | 35 | 65.3 | 1.36 | |
| Fort Meade | 82 | 31 | 58.4 | 5.56 | |
| Fort Pierce | 81 | 30 | 61.4 | 2.74 | |
| Gainesville | 78 *c* | 31 *c* | 50.9 *c* | 11.79 | |
| Grasmere | 77 | 32 | 55.6 | ..... | |
| Huntington | 80 | 24 | 52.4 | 6.32 | |
| Hypoluxo | 83 | 35 | 64.4 | 1.76 | |
| Inverness | 81 | 27 | 53.4 | 5.74 | |
| Jasper | 79 | 24 | 48.8 | 6.23 | |
| Johnstown | 77 *f* | 26 *c* | 48.6 *j* | 5.31 | |
| Kissimmee | 76 | 32 | 58.7 | 4.16 | |
| Lake City | 75 | 26 | 50.6 | 4.68 | |
| Macclenny | 80 | 24 | 50.4 | 6.35 | |
| Madison | 76 | 25 | 50.2 | 6.50 | |
| Malabar | 83 | 35 | 59.4 | 4.85 | |
| Manatee | 81 | 33 | 59.0 | 4.55 | |
| Marco | 81 | 41 | 63.8 | 3.00 | |
| Merritt Island | 78 | 39 | 59.0 | 6.47 | |
| Miami | 84 | 36 | 67.6 | 1.70 | |
| Middleburg | 78 | 22 | 51.0 | 7.95 | |
| Molino | 75 | 20 | 47.6 | 2.97 | |
| Myers | 79 | 34 | 60.9 | 3.12 | |
| New Smyrna | ..... | ..... | ..... | 5.95 | |
| Nocatee | 83 | 31 | 60.8 | 4.96 | |
| Ocala | 83 | 28 | 54.2 | 7.17 | |
| Orange City | 83 | 24 | 56.5 | 5.52 | |
| Orange Home | 88 | 29 | 56.2 | 4.97 | |
| Orlando | 83 | 32 | 58.2 | 4.02 | |
| *Florida*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Pinemount | 75 | 24 *c* | 48.0 *b* | 5.99 | |
| Plant City | 83 | ..... | ..... | 1.20 | |
| Quincy | 72 | 29 | 51.6 | 4.82 | |
| Rockwell | 79 | 22 | 55.6 | 7.85 | |
| St. Andrews | 70 | 25 | 48.9 | 3.74 | |
| St. Augustine | 80 | 28 | 53.1 | 7.94 | |
| St. Leo | 82 | 32 | 56.8 | 6.15 | |
| Stephensville | 77 | 24 | 50.0 | 5.98 | |
| Sumner | 76 | 24 | 52.4 | 7.30 | |
| Switzerland | 77 | 27 | 50.4 | 8.36 | |
| Tallahassee | 70 | 25 | 50.0 | 6.60 | |
| Tarpon Springs | 85 | 33 | 56.3 | 5.09 | |
| Wausau | 70 | 23 | 48.1 | 6.80 | |
| Wewahitchka | 72 | 26 | 48.9 | 3.67 | |
| *Georgia.* | | | | | |
| Abbeville | ..... | ..... | ..... | 3.40 | |
| Adairsville | 65 | 15 | 37.9 | 4.83 | 5.5 |
| Albany | 71 | 25 | 47.4 | 4.58 | |
| Allapaha | 72 | 23 | 45.2 | 4.46 | |
| Alpharetta | 63 | 14 | 37.6 | 3.43 | 7.0 |
| Americus | 68 | 20 | 42.7 | 4.82 | |
| Athens | 62 | 16 | 36.6 | 2.92 | 0.5 |
| Blakely | 68 | 20 | 47.0 | 3.75 | |
| Bowersville | 66 | 15 | 38.8 | 2.08 | 3.0 |
| Butler | ..... | ..... | ..... | 4.27 | T. |
| Camak | 68 | 15 | 41.6 | 2.60 | T. |
| Canton | ..... | ..... | ..... | 3.51 | 7.0 |
| Carlton | ..... | ..... | ..... | 3.05 | |
| Clayton | 60 | 4 | 36.0 | 3.71 | 8.8 |
| Columbus | 68 *c* | 21 *c* | 43.4 *c* | 5.10 | |
| Cordele | 71 | 20 | 42.4 | 3.61 | |
| Covington | 69 *f* | 15 | 41.7 *c* | 2.39 | T. |
| Dahlonega | 62 | 10 | 36.2 | 3.25 | 8.2 |
| Dawson | 69 | 18 | 45.2 | 4.03 | |
| Diamond | 65 | 7 | 38.2 | 6.26 | 15.0 |
| Dublin | ..... | ..... | ..... | 2.17 | |
| Dudley | 70 | 18 | 43.8 | 2.37 | T. |
| Eastman | ..... | ..... | ..... | 2.65 | |
| Eatonton | 67 | 17 | 42.4 | 3.60 | |
| Elberton | 63 | 16 | 39.7 | 3.37 | 0.1 |
| Experiment | 64 | 16 | 40.4 | 3.16 | 0.6 |
| Fitzgerald | 69 | 19 | 42.8 | 5.60 | |
| Fleming | 75 | 20 | 47.2 | 3.90 | |
| Fort Gaines | ..... | ..... | ..... | 2.95 | |
| Gainesville | 61 | 16 | 35.3 | 3.27 | 6.0 |
| Gillsville | 67 | 14 | 38.8 | 2.87 | 4.5 |
| Greenbush | 63 | 15 | 38.1 | 2.53 | 3.2 |
| Greensboro | 68 | 16 | 38.8 | 3.15 | |
| Griffin | 66 | 14 | 39.6 | 3.75 | 0.5 |
| Harrison | 69 | 19 | 43.6 | 2.39 | 9.1 |
| Hawkinsville | 70 | 17 | 41.8 | 3.45 | |
| Hephzibah | ..... | 16 | ..... | 3.00 | T. |
| Jesup | 74 | 21 | 46.0 | 5.03 | |
| Lost Mountain | 64 | 12 | 39.0 | 3.82 | 9.0 |
| Louisville | 70 | 18 | 42.0 | 1.90 | |
| Lumpkin | 67 | 20 | 44.0 | 5.20 | |
| Marshallville | 68 | 19 | 44.0 | 5.30 | |
| Mauzy *b* | 73 | 24 | 48.8 | | |
| Milledgeville | 68 | 16 | 40.3 | 2.25 | |
| Millen | 71 | 19 | 43.8 | 2.78 | |
| Monticello | 67 | 16 | 40.8 | 3.63 | |
| Morgan | 65 | ..... | ..... | 5.23 | |
| Naylor | 74 | 25 | 46.8 | 4.65 | |
| Newnan | 63 | 15 | 37.7 | 3.85 | 0.4 |
| Oakdale | ..... | ..... | ..... | 4.06 | 8.0 |
| Oakfield | ..... | ..... | ..... | 4.94 | |
| Point Peter | 67 | 11 | 38.6 | 3.62 | T. |
| Poulan | 71 | 19 | 45.0 | 5.75 | |
| Putnam | 68 | 20 | 43.1 | 4.93 | |
| Quitman | 74 | 24 | 47.3 | 5.42 | |
| Ramsey | 63 | 12 | 39.2 | 3.61 | 3.0 |
| Resaca | ..... | ..... | ..... | 4.57 | 8.0 |
| Rome | 66 | 14 | 38.4 | 3.81 | 6.0 |
| St. Marys | 76 | 25 | 48.8 | 6.92 | |
| Statesboro | 72 | 21 | 45.2 | 4.07 | |
| Talbotton | 66 | 18 | 42.8 | 4.14 | T. |
| Tallapoosa | 61 | 6 | 36.0 | 5.29 | 10.0 |
| Thomasville | 71 | 25 | 48.3 | 4.65 | |
| Toccoa | 64 | 12 | 37.7 | 3.07 | 4.0 |
| Valona | 74 | 25 | 46.9 | 6.03 | |
| Washington | 66 | 17 | 38.1 | 2.80 | T. |
| Waverly | 75 | 23 | 47.8 | 6.77 | |
| Waycross | 73 | 24 | 45.8 | 5.13 | |
| Waynesboro | 66 | 19 | 41.7 | 0.86 | |
| Westpoint | 65 | 15 | 39.7 | 4.41 | T. |
| Woodbury | 66 | 12 | 38.8 | 2.85 | |
| *Idaho.* | | | | | |
| Albion | 48 | 7 | 28.8 | 2.00 | 14.0 |
| American Falls | 43 | 4 | 24.0 | 0.85 | ..... |
| Blackfoot | 46 | − 4 | 20.4 | 0.60 | 6.0 |
| Blue Lakes | 56 | 13 | 32.0 | 1.37 | 7.5 |
| Burnside | 36 | − 8 | 16.2 | 0.30 | 3.0 |
| Cambridge | 49 | −19 | 18.0 | 1.74 | 17.4 |
| Chesterfield | 43 | −24 | 17.2 | 0.64 | 9.0 |
| Forney | 50 | −16 | 21.2 | 2.15 | 21.5 |
| Garnet | 60 | 15 | 35.3 | 0.12 | ..... |
| Grangeville | 48 | 7 | 31.6 | 2.25 | 22.5 |
| Lake | 32 | −14 | 15.2 | 3.40 | 34.0 |

5——5

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

| Stations. | Temperature. (Fahrenheit.) | | | Precipitation. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Rain and melted snow. | Total depth of snow. |
| *Idaho*—Cont'd. | ° | ° | ° | Ins. | Ins. |
| Lakeview | 47[c] | 16[c] | 32.6[c] | 2.27 | 10.0 |
| Lost River | 41 | −12 | 13.8 | 0.16 | 2.0 |
| Meadows | 40 | −16 | 20.6 | 2.27 | 28.2 |
| Moscow | 45 | 11 | 30.4 | 1.22 | 11.0 |
| Milner [c] | 50 | 13 | 30.0 | 0.32 | 3.2 |
| Murray | 44 | 3 | 29.4 | 4.39 | 31.0 |
| Oakley | 48 | 7 | 28.1 | 0.25 | 3.0 |
| Ola | 50 | −7 | 25.9 | 2.23 | 19.2 |
| Orofino | 48 | 15 | 32.5 | 3.69 | 18.5 |
| Paris | 54 | −18 | 9.7 | ...... | ...... |
| Payette | 49 | 3 | 28.9 | 2.62 | 21.0 |
| Pollock | 52 | 13 | 34.7 | 0.60 | 4.0 |
| Porthill | 45 | 8 | 29.7 | 2.01 | 24.0 |
| Priest River | ...... | ...... | ...... | 2.34 | ...... |
| Riddle | 47 | −14 | 20.4 | 1.62 | 16.2 |
| Roosevelt | 40[f] | −8[f] | 17.6[f] | 1.40 | 25.5 |
| St. Maries | 48 | 10 | 32.8 | 2.89 | 23.0 |
| Soldier | 41 | −16 | 12.6 | 1.25 | 18.0 |
| Swan Valley | 53 | −17 | 19.6 | 0.60 | 6.0 |
| Vernon | 39 | −10 | 15.0 | 1.47 | 14.7 |
| Weston | 44 | −12 | 19.0 | 0.82 | 8.5 |
| *Illinois.* | | | | | |
| Albion | 56 | −12 | 26.3 | 4.47 | 18.7 |
| Aledo | 45 | −15 | 17.2 | 1.84 | 4.9 |
| Alexander | 53 | −15 | 20.6 | 1.74 | 10.5 |
| Antioch | 38 | −25 | 12.4 | 0.55 | 5.5 |
| Ashton | 40 | −19 | 12.6 | 2.18 | 7.2 |
| Astoria | 42 | −20 | 17.6 | 4.15 | 23.0 |
| Aurora | 39 | −20 | 15.2 | 2.12 | 5.0 |
| Benton | 58 | −7 | 29.8 | 2.67 | 16.5 |
| Bloomington | 42 | −11 | 19.6 | 3.71 | 16.3 |
| Bushnell | 44 | −16 | 18.6 | 3.45 | 11.0 |
| Cambridge | 41 | −13 | 16.0 | 2.08 | 4.1 |
| Carlinville | 55 | −16 | 23.3 | 2.64 | 11.0 |
| Carrollton | 57 | −11 | 23.4 | 2.30 | 8.3 |
| Charleston | 50 | −17 | 22.5 | 3.92 | 19.9 |
| Chester | ...... | ...... | ...... | 2.74 | 7.2 |
| Chicago Heights | ...... | ...... | ...... | 2.21 | 7.0 |
| Cisne | 56 | −22 | 27.1 | 3.04 | 11.5 |
| Coatsburg | 47 | −16 | 18.2 | 3.42 | 13.5 |
| Cobden | 59 | −5 | 30.9 | 4.05 | 4.2 |
| Danville | 50 | −14 | 20.8 | 4.44 | 19.5 |
| Decatur | 51 | −15 | 20.6 | 2.73 | 15.4 |
| Dixon | ...... | ...... | ...... | 2.23 | 3.8 |
| Equality | 60 | −13 | 30.1 | 4.39 | 9.2 |
| Fandon | 48 | −16 | 18.6 | 2.93 | 7.8 |
| Flora | 54 | −25 | 23.8 | 2.37 | 11.7 |
| Friendgrove | 56 | −12 | 26.5 | 4.42 | 17.4 |
| Galva | 41 | −13 | 16.1 | 2.18 | 9.9 |
| Grafton | ...... | ...... | ...... | 3.50 | 11.0 |
| Greenville | 54 | −9 | 24.4 | 4.25 | 20.4 |
| Griggsville | 50 | −13 | 22.2 | 3.93 | ...... |
| Halfway | 58 | −2 | 30.8 | 3.60 | 8.0 |
| Havana | 45 | −15 | 19.5 | 3.11 | 13.0 |
| Henry | 42 | −17 | 17.8 | 2.84 | 10.0 |
| Hillsboro | 53 | −20 | 23.0 | 3.15 | 16.0 |
| Hoopeston | ...... | ...... | ...... | 5.20 | 30.2 |
| Joliet | 38 | −12 | 16.4 | 2.42 | 10.3 |
| Kishwaukee | 40 | −21 | 13.0 | 2.90 | 7.0 |
| Knoxville | 44 | −18 | 16.1 | 3.06 | 12.1 |
| Lagrange | 39 | −18 | 16.2 | 1.65 | 3.5 |
| Laharpe | 42 | −20 | 18.2 | 5.48 | 12.5 |
| La Salle | 48 | −14 | 18.0 | 1.96 | 6.0 |
| Loami | ...... | ...... | ...... | 2.44 | 9.2 |
| McLeansboro | 57 | −10 | 28.7 | 3.78 | 14.5 |
| Martinsville | 51[b] | −22[b] | 19.9[b] | 3.57 | 15.0 |
| Martinton | 48 | −15 | 17.6 | 2.02 | 11.9 |
| Mascoutah | 54 | −20 | 24.0 | 3.15 | 16.0 |
| Mattoon | ...... | ...... | ...... | 3.18 | 15.3 |
| Minonk | 39 | −16 | 16.4 | 2.51 | 9.0 |
| Monmouth | 41 | −17 | 15.9 | 2.85 | 10.7 |
| Morrison | 42 | −18 | 14.8 | 2.53 | 9.5 |
| Morrisonville | 53 | −14 | 21.7 | 2.33 | 11.0 |
| Mount Carmel | ...... | ...... | ...... | 4.82 | 21.0 |
| Mount Pulaski | 50 | −13 | 20.0 | 2.74 | 16.3 |
| Mount Vernon | 56 | −3 | 26.3 | 3.33 | 15.0 |
| New Burnside | 59 | −6 | 31.8 | 4.49 | 12.5 |
| Olney | 56 | −17 | 25.6 | 4.00 | 16.5 |
| Ottawa | 42 | −11 | 18.8 | 2.54 | 10.9 |
| Palestine | 53 | −19 | 24.0 | 4.10 | 14.5 |
| Pana | 51 | −10 | 22.0 | 2.85 | 11.5 |
| Paris | 50 | −8 | 19.8 | 1.25 | ...... |
| Preoia a | ...... | ...... | ...... | 3.04 | ...... |
| Peoria b | 47 | −9 | 21.2 | 1.87 | 9.9 |
| Philo | 50 | −22 | 17.8 | 3.17 | 15.8 |
| Plumhill | 56 | −12 | 27.2 | 2.26 | 8.9 |
| Pontiac | 41 | −13 | 18.1 | 3.92 | 17.0 |
| Rantoul | 48 | −20 | 18.7 | 3.95 | 21.3 |
| Raum | 59 | −5 | 31.4 | 4.87 | 4.5 |
| Riley | 37 | −22 | 13.3 | 1.79 | 7.7 |
| Robinson | 54 | −17 | 23.6 | 4.82 | 25.5 |
| Rushville | 45 | −16 | 20.2 | 3.07 | 12.5 |
| St. Charles | 38 | −21 | 15.2 | 2.30 | 12.2 |
| St. John | 58 | −11 | 28.2 | 2.63 | 4.5 |
| Shobonier | 55 | −22 | 25.0 | 3.37 | 19.7 |
| Streator | 41 | −13 | 17.6 | 2.28 | 6.1 |
| Sullivan | 51 | −13 | 21.2 | 2.82 | 11.6 |
| Sycamore | 39 | −19 | 12.6 | 1.31 | 5.5 |

| Stations. | Temperature. (Fahrenheit.) | | | Precipitation. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Rain and melted snow. | Total depth of snow. |
| *Illinois*—Cont'd. | ° | ° | ° | Ins. | Ins. |
| Tilden | 56 | −10 | 27.8 | 2.39 | 11.2 |
| Tiskilwa | 38 | −13 | 16.2 | 2.53 | 8.3 |
| Tuscola | 51 | −17 | 18.6 | 2.69 | 15.5 |
| Urbana | 50 | −15 | 17.9 | 3.09 | 18.2 |
| Walnut | 41 | −13 | 17.4 | 2.22 | 5.3 |
| Winchester | 55 | −14 | 21.8 | 3.14 | 14.2 |
| Windsor | 51 | −22 | 20.7 | 3.22 | 14.2 |
| Winnebago | 40 | −21 | 12.5 | 1.74 | 7.0 |
| Yorkville | 40 | −18 | 14.6 | 2.05 | 5.9 |
| Zion | 49 | −21 | 13.0 | 0.65 | 2.0 |
| *Indiana.* | | | | | |
| Anderson | 47 | −13 | 20.0 | 4.33 | 19.6 |
| Angola | 37 | −11 | 16.8 | 3.96 | 16.9 |
| Auburn | 40 | −20 | 18.0[b] | 4.28 | ...... |
| Bloomington | 54 | −11 | 24.3 | 5.50 | 24.0 |
| Bluffton | 43 | −23 | 17.3 | 4.61 | 17.5 |
| Butlerville | 56 | −14 | 25.7 | 5.40 | 14.6 |
| Cambridge City | 49 | −24 | 18.4 | 5.03 | 15.6 |
| Columbus | 52 | −22 | 24.4 | 5.08 | 18.5 |
| Connersville | 51 | −15 | 21.2 | 4.67 | 22.0 |
| Crawfordsville | 64 | −17[i] | 18.4[f] | 1.58 | 12.8 |
| Delphi | 48 | −20 | 16.4 | 5.16 | 24.5 |
| Elkhart | 38 | −12 | 16.2 | 2.79 | 17.9 |
| Farmersburg | 52 | −22 | 21.7 | 4.68 | ...... |
| Farmland | 48 | −20 | 20.6 | 4.32 | 21.7 |
| Fort Wayne | 41[c] | −12[c] | 18.2[c] | ...... | 19.0 |
| Franklin *[1] | 50 | −14 | 24.2 | 4.64 | 13.2 |
| Greencastle | 51 | −10 | 21.7 | 3.74 | 17.3 |
| Greenfield | 49 | −12 | 19.7 | 2.28 | 2.8 |
| Greensburg | 53 | −13 | 23.7 | 4.90 | 19.0 |
| Hammond | 40 | −13 | 17.8 | 2.39 | 14.0 |
| Hector | 45 | −26 | 17.6 | 6.15 | 21.0 |
| Holland | 56 | −13 | 29.3 | 4.36 | 6.2 |
| Huntington | 42 | −12 | 16.0 | 5.19 | 20.0 |
| Jeffersonville | 57 | 5 | 30.7 | 2.40 | 1.5 |
| Kokomo | 46 | −12 | 18.8 | 7.26 | 25.9 |
| Lafayette | 50 | −16 | 17.0 | 5.07 | 24.5 |
| Laporte | 38 | −9 | 15.6 | 2.66 | 21.0 |
| Logansport | 44 | −15 | 16.6 | 3.29 | 19.4 |
| Madison a | 57 | −7 | 28.2 | 3.56 | 3.0 |
| Marengo | 57 | −5 | 29.3 | 2.88 | 1.8 |
| Marion | 44 | −18 | 18.2 | 4.91 | 22.0 |
| Markle | 44 | −22 | 17.4 | 6.40 | 20.0 |
| Mauzy | 48 | −19 | 20.6 | 4.40 | 14.5 |
| Moores Hill | 53 | −11 | 24.8 | 3.29 | 9.1 |
| Northfield | 49 | −23 | 17.1 | 4.65 | 21.0 |
| Paoli | 57 | −14 | 26.7 | 3.86 | 13.5 |
| Princeton | 57 | −16 | 26.7 | 6.10 | 23.0 |
| Rensselaer | 42 | −15 | 17.6 | 4.22 | 21.0 |
| Richmond | 59 | −26 | 19.6 | 3.46 | 12.4 |
| Rockville | 50 | −14 | 20.1 | 4.44 | 17.0 |
| Rome | 60 | −3 | 30.8 | 2.26 | 1.1 |
| Salem | 58 | −19 | 27.4 | 3.97 | 15.2 |
| Scottsburg | 58 | −1 | 29.6 | 3.45 | 2.5 |
| Seymour | 61 | −12 | 25.0 | 3.75 | 12.8 |
| Shelbyville | 49 | −13 | 22.4 | 3.20 | 22.5 |
| South Bend | 38 | −11 | 15.5 | 3.76 | 21.0 |
| Syracuse | 39 | −17 | 17.2 | 5.46 | 33.5 |
| Terre Haute | 52 | −6 | 24.8 | 4.59 | 23.5 |
| Topeka | 38 | −14 | 15.5 | ...... | ...... |
| Valparaiso | 40 | −14 | 18.2 | 2.48 | ...... |
| Veedersburg | 50[d] | −21 | 20.0[d] | 3.52 | 9.3 |
| Vevay | 57 | −4 | 28.4 | 2.40 | 8.0 |
| Vincennes | 56 | −14 | 24.2 | 5.52 | ...... |
| Washington | 54 | −7 | 24.7 | 5.56 | 18.7 |
| *Indian Territory.* | | | | | |
| Ardmore | 71 | 7 | 78.0 | 1.61 | 4.0 |
| Chickasha | 69 | 4 | 36.4 | 1.67 | 1.0 |
| Claremore | 65 | 1 | 36.7 | 9.00 | |
| Coalgate | ...... | ...... | ...... | 1.80 | |
| Durant | 71 | 7 | 42.0 | 2.10 | |
| Fairland | 66 | −3 | 35.8 | 3.91 | 1.0 |
| Goodwater | 70 | 9 | 39.2 | 3.57 | 3.0 |
| Hartshorne | 70 | 4 | 40.2 | 2.35 | 4.0 |
| Healdton | 76 | 5 | 38.6 | 2.42 | 4.0 |
| Holdenville | 71 | 4 | 39.2 | 2.68 | 0.5 |
| Marlow | 70 | 5 | 35.2 | 1.83 | 4.0 |
| Muskogee | 65 | 1 | 34.4 | 3.37 | T. |
| Okmulgee | 67 | 3 | 38.0 | 3.93 | T. |
| Pauls Valley | 70 | 4 | 38.2 | 0.55 | 3.0 |
| Ravia | 70 | 8 | 41.1 | 1.57 | 1.4 |
| South McAlester | 67 | 4 | 40.8 | 2.76 | 5.0 |
| Tulsa | ...... | ...... | ...... | 2.73 | 2.0 |
| Vinita | 66 | −3 | 35.6 | 2.55 | T. |
| Webbers Falls | 69 | 1 | 36.2 | 2.83 | 2.0 |
| *Iowa.* | | | | | |
| Afton | 50 | −18 | 18.2 | 2.02 | 6.0 |
| Albia | 50 | −19 | 15.8 | 3.01 | 8.5 |
| Algona | 41 | −28 | 10.6 | 0.40 | 4.0 |
| Allerton | 51 | −21 | 18.8 | 2.60 | 6.1 |
| Alta | 41 | −26 | 11.1 | 0.37 | 4.0 |
| Amana | 45 | −18 | 15.4 | 1.73 | 7.4 |
| Ames | 46 | −24 | 14.0 | 0.50 | 7.0 |
| Atlantic | 52 | −31 | 17.6 | 1.36 | 3.5 |
| Audubon | 48 | −23 | 14.0 | 0.33 | 3.6 |
| Baxter | 49 | −21 | 14.7 | 1.35 | 3.5 |
| Bedford | 52 | −23 | 19.0 | 2.87 | 6.1 |
| Belknap | ...... | ...... | ...... | 2.57 | 19.0 |

| Stations. | Temperature. (Fahrenheit.) | | | Precipitation. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Rain and melted snow. | Total depth of snow. |
| *Iowa*—Cont'd. | ° | ° | ° | Ins. | Ins. |
| Belleplaine | 44 | −22 | 14.1 | 3.42 | 11.2 |
| Bonaparte | 45 | −21 | 16.6 | 2.61 | 6.0 |
| Britt | 40 | −28 | 8.9 | 0.46 | 4.6 |
| Buckingham | ...... | ...... | ...... | 0.75 | 7.6 |
| Burlington | 46 | −15 | 18.7 | 3.10 | ...... |
| Carroll | 49 | −25 | 13.0 | 0.50 | 5.0 |
| Cedar Rapids | 45 | −19 | 12.8 | 1.01 | ...... |
| Chariton | 50 | −20 | 17.4 | 2.15 | ...... |
| Charles City | 34 | −31 | 6.6 | 0.44 | 7.2 |
| Clarinda | 54 | −17 | 17.8 | 2.12 | 8.0 |
| Clearlake | 49 | −30 | 9.8 | 0.62 | 6.2 |
| Clinton | 44 | −17 | 15.0 | 2.25 | 6.8 |
| College Springs | 53 | −15 | 19.6 | 2.39 | 13.5 |
| Columbus Junction | 49 | −14 | 17.6 | 1.98 | 5.2 |
| Corning | 52 | −24 | 17.6 | 2.29 | 9.8 |
| Corydon | 51 | −23 | 17.2 | 2.33 | 8.2 |
| Council Bluffs | ...... | ...... | ...... | 0.53 | 5.3 |
| Cresco | 38[d] | −29[d] | 10.0[d] | 0.38 | 3.8 |
| Cumberland | ...... | ...... | ...... | 2.10 | 9.0 |
| Decorah | 38 | −31 | 8.4 | 0.64 | 12.0 |
| Delaware | 41 | −25 | 11.2 | 0.57 | 5.0 |
| Denison | 47 | −23 | 14.6 | 0.53 | 5.3 |
| Dows | 42 | −27 | 10.3 | 0.70 | 7.0 |
| Earlham | 49 | −22 | 14.0 | 1.37 | 8.7 |
| Elkader | 42 | −32 | 10.2 | 0.51 | 5.8 |
| Estherville | 40 | −31 | 7.5 | 0.43 | ...... |
| Fayette | 40 | −32 | 8.4 | 0.08 | ...... |
| Forest City | 40 | −29 | 8.7 | 0.40 | 4.0 |
| Fort Dodge | 43 | −25 | 12.4 | 0.30 | 3.0 |
| Fort Madison | ...... | ...... | ...... | 3.15 | 9.0 |
| Galva | 42 | −27 | 11.8 | 0.55 | 3.2 |
| Gilman | ...... | ...... | ...... | 1.03 | 2.0 |
| Glenwood | 55 | −18 | 20.7 | 0.55 | 4.0 |
| Grand Meadow | 40 | −29 | 10.0 | 0.60 | 6.2 |
| Greenfield | 47 | −20 | 16.8 | 1.71 | 9.8 |
| Grinnell | 46 | −20 | 14.9 | 1.52 | 5.2 |
| Grundy Center | 43 | −26 | 12.6 | 0.78 | 5.5 |
| Guthrie Center | 59 | −23 | 18.5 | 0.91 | ...... |
| Hampton | 41 | −27 | 10.8 | 0.80 | 7.5 |
| Hanlontown | 41 | −31 | 8.7 | ...... | ...... |
| Harlan | 49 | −20 | 16.5 | 0.93 | 5.8 |
| Hopeville | 51 | −20 | 18.0 | 2.43 | ...... |
| Humboldt | 46 | −28 | 11.5 | 0.29 | 2.9 |
| Ida Grove | 47 | −26 | 14.5 | 0.46 | 4.6 |
| Independence | 40 | −26 | 10.4 | 0.63 | 6.4 |
| Indianola | 51 | −19 | 16.8 | 2.69 | 9.3 |
| Inwood | 38 | −26 | 11.2 | 0.40 | 4.0 |
| Iowa City | 47 | −21 | 13.7 | 1.74 | ...... |
| Iowa Falls | 78 | −26 | 9.6 | 0.67 | 6.2 |
| Jefferson | ...... | ...... | ...... | 0.91 | 7.4 |
| Keosauqua | 48[e] | −24[b] | 14.8[b] | 2.64 | 9.3 |
| Knoxville | 50 | −17 | 17.2 | 2.15 | 4.5 |
| Lacona | ...... | ...... | ...... | 3.68 | 11.0 |
| Larrabee | 41 | −27 | 11.9 | 0.16 | 1.8 |
| Leclaire | ...... | ...... | ...... | 1.48 | 3.2 |
| Lemars | 43 | −23 | 14.3 | 0.35 | 3.5 |
| Lenox | 51 | −21 | 17.6 | 1.82 | 4.3 |
| Leon | 50 | −17 | 19.2 | 0.72 | 8.0 |
| Logan | 50 | −17 | 17.4 | 1.20 | 12.0 |
| Maple Valley | ...... | ...... | ...... | 0.50 | 5.0 |
| Maquoketa | 45 | −22 | 11.8 | 1.31 | 4.0 |
| Marshalltown | 45 | −22 | 13.1 | 1.04 | 5.1 |
| Mason City | 38 | −26 | 11.2 | 0.62 | 6.2 |
| Monticello | 45 | −22 | 13.9 | ...... | ...... |
| Mountayr | 53 | −18 | 19.4 | 2.91 | 14.0 |
| Mount Pleasant | 47 | −20 | 17.4 | 1.79 | ...... |
| Mount Vernon | 43 | −19 | 14.0 | 1.20 | 7.5 |
| New Hampton | 39[d] | −29[d] | 7.8[d] | 0.50 | 5.0 |
| Newton | 47 | −23 | 15.0 | 1.53 | 6.0 |
| Northwood | ...... | −28 | ...... | 0.80 | 8.0 |
| Odebolt | 44 | −25 | 13.8 | 0.40 | 3.2 |
| Ogden | 51 | −30 | 11.8 | 0.80 | 8.0 |
| Olin | 42 | −23 | 14.0 | 1.57 | 7.5 |
| Onawa | 50 | −16 | 18.3 | 0.82 | 8.0 |
| Osage | 39 | −28 | 9.6 | 0.53 | 5.3 |
| Osceola | 42 | −19 | 17.0 | ...... | ...... |
| Oskaloosa | 49 | −23 | 15.6 | 1.58 | 5.0 |
| Ottumwa | ...... | ...... | ...... | 2.40 | 3.6 |
| Pacific Junction | 52 | −16 | 18.7 | 0.59 | 3.7 |
| Perry | 48 | −23 | 14.4 | 0.66 | 6.6 |
| Plover | 42 | −30 | 9.9 | 0.60 | 6.0 |
| Primghar | 38 | −25 | 10.4 | ...... | ...... |
| Redoak | 57 | −14 | 21.6 | 0.97 | 11.0 |
| Ridgeway | 41 | −28 | 11.3 | 1.29 | 8.1 |
| Rock Rapids | 40 | −24 | 11.0 | 0.30 | 3.0 |
| Rockwell City | 43 | −28 | 12.8 | 0.80 | 8.0 |
| Sac City | 43 | −26 | 13.2 | 0.67 | 6.8 |
| St. Charles | 53 | −18 | 17.7 | 2.31 | 8.5 |
| Sheldon | 39 | −27 | 10.5 | 0.21 | 2.1 |
| Sibley | 35 | −28 | 7.5 | 0.37 | 2.2 |
| Sigourney | 48 | −19 | 16.8 | 2.21 | ...... |
| Sioux Center | 40 | −25 | 12.2 | 0.50 | 5.0 |
| Spirit Lake | 40 | −28 | 10.8 | 0.55 | 5.5 |
| Stockport | ...... | ...... | ...... | 2.52 | 6.5 |
| Storm Lake | 41 | −30 | 11.3 | 0.02 | 0.4 |
| Stuart | 54 | −19 | 17.0 | 1.17 | 11.2 |
| Thurman | 53 | −20 | 19.2 | 0.42 | 7.0 |
| Tipton | 45 | −18 | 15.7 | 1.89 | 7.0 |

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

| Stations. | Temperature. (Fahrenheit.) Maximum. | Minimum. | Mean. | Precipitation. Rain and melted snow. | Total depth of snow. |
|---|---|---|---|---|---|
| | ° | ° | ° | Ins. | Ins. |
| *Iowa*—Cont'd. | | | | | |
| Toledo | 46 | −23 | 13.8 | 0.97 | 5.5 |
| Villisca | 49 | −21 | 18.6 | 1.75 | ..... |
| Vinton | ..... | ..... | ..... | 1.04 | 7.2 |
| Wapello | 47 | −12 | 18.3 | 1.71 | ..... |
| Washington | 50 | −20 | 14.7 | 2.28 | ..... |
| Washta | ..... | ..... | ..... | 0.35 | 3.5 |
| Waterloo | 42 | −25 | 12.6 | 0.71 | 5.0 |
| Waukee | 49 | −19 | 17.6 | 2.25 | 9.5 |
| Waverly | 39 | −27 | 9.8 | 0.78 | 7.8 |
| Westbend | 42 | −29 | 11.0 | 0.59 | 5.9 |
| West Union | ..... | ..... | ..... | 0.33 | 3.4 |
| Whitten | 43 | −28 | 11.6 | 0.75 | 2.5 |
| Wilton Junction | 47 | −18 | 16.4 | ..... | 5.0 |
| Winterset | 52 | −19 | 18.2 | ..... | 1.2 |
| Woodburn | ..... | ..... | ..... | 2.70 | 6.7 |
| *Kansas.* | | | | | |
| Achilles | 66 | −10 | 27.4 | 0.11 | 1.1 |
| Alton | 68 | −7 | 27.7 | T. | T. |
| Anthony | ..... | ..... | ..... | 0.41 | T. |
| Atchison | 54 | −12 | 25.4 | 1.19 | 5.5 |
| Baker | 55 | −14 | 22.0 | 1.05 | 0.7 |
| Beloit | 55 | −8 | 26.6 | 0.10 | T. |
| Burlington | 64 | −12 | 31.1 | 1.46 | 3.0 |
| Chanute[g] | 64 | −1 | 35.6 | ..... | ..... |
| Clay Center | 64 | −11 | 27.4 | 0.55 | T. |
| Coffeyville | 69 | −5 | 35.2 | 0.18 | T. |
| Colby | 67 | −5 | 27.0 | T. | T. |
| Columbus | 62 | −6 | 32.2 | 1.64 | 0.8 |
| Cunningham | 68 | −9 | 32.8 | T. | T. |
| Dresden | 65 | −6 | 29.2 | 0.15 | 1.5 |
| Eldorado | 71 | −9 | 31.6 | 0.49 | 1.5 |
| Ellinwood | 65 | −6 | 30.6 | 0.14 | 1.1 |
| Emporia | 61 | −10 | 30.8 | 0.42 | 0.3 |
| Englewood | 70 | −1 | 33.2 | 0.09 | 0.2 |
| Enterprise | 59 | −13 | 27.7 | 0.24 | T. |
| Eureka | ..... | ..... | ..... | 1.05 | 0.5 |
| Eureka Ranch | 67 | −7 | 27.9 | 0.16 | 1.6 |
| Fall River | 65 | −12 | 32.2 | 0.38 | 0.2 |
| Farnsworth | 69 | −7 | 29.2 | 0.02 | 0.2 |
| Forsha | 61 | −13 | 28.4 | 0.05 | 0.5 |
| Fort Leavenworth | 56 | −11 | 27.2 | 1.38 | 5.5 |
| Fort Scott | 63 | −9 | 33.1 | 1.58 | 1.2 |
| Frankfort | 59 | −12 | 24.8 | 1.00 | 4.5 |
| Garden City | 70 | −6 | 29.4 | 0.10 | 1.0 |
| Gove*[1] | 65 | −2 | 29.0 | T. | T. |
| Grenola | 65 | −10 | 30.6 | 0.35 | T. |
| Hanover | 63 | −9 | 26.8 | ..... | 0.8 |
| Harrison | 62 | −15 | 25.4 | 0.05 | 0.1 |
| Hays | 60 | −9 | 27.6 | 0.10 | 1.0 |
| Holton | 56 | −14 | 24.8 | 0.36 | 0.5 |
| Horton | 55 | −12 | 24.4 | 0.82 | 0.8 |
| Hoxie | 65 | −4 | 28.8 | 0.12 | 1.2 |
| Hutchinson | 68 | −11 | 27.6 | 0.16 | 0.5 |
| Independence | 61 | −5 | 32.9 | 1.44 | 0.5 |
| Jetmore | 64[f] | −4 | 28.4[c] | T. | T. |
| La Crosse | 65 | −6 | 29.0 | 0.05 | 0.5 |
| Lakin | 69 | −3 | 29.2 | T. | T. |
| Lawrence | 55 | −10 | 27.2 | 0.77 | 1.0 |
| Lebanon | 60 | −12 | 26.6 | 0.10 | 1.0 |
| Lebo | 59 | −12 | 28.6 | 0.68 | 0.5 |
| Macksville | 67 | −3 | 31.6 | 0.05 | T. |
| McPherson | 65 | −10 | 27.8 | 0.22 | T. |
| Madison | 64 | −13 | 29.0 | 0.86 | 2.0 |
| Manhattan *b* | 61 | −13 | 27.4 | 0.65 | 3.0 |
| Manhattan *c* | 64 | −11 | 26.6 | 0.48 | 2.3 |
| Marion | 59[e] | −19[e] | 28.8[c] | 0.30 | 3.0 |
| Medicine Lodge | 72 | −6 | 33.9 | 0.01 | 0.1 |
| Minneapolis | 60 | −10 | 27.8 | 0.32 | 1.4 |
| Moran | 61 | −11 | 31.4 | 1.62 | 0.5 |
| Mounthope | 64 | −2 | 32.2 | 0.20 | 1.5 |
| Ness City | 68 | −3 | 30.8 | T. | T. |
| Newton | ..... | ..... | ..... | 0.10 | 1.0 |
| Norton | 66 | −9 | 28.4 | 0.02 | 0.2 |
| Norwich | 70 | −7 | 32.6 | 0.08 | 0.5 |
| Oberlin | ..... | ..... | ..... | 0.00 | |
| Olathe | 57 | −13 | 28.2 | 0.87 | 1.5 |
| Osborne | ..... | ..... | ..... | 0.18 | 1.0 |
| Oswego | 63 | −7 | 34.2 | 1.65 | 1.0 |
| Ottawa | 59 | −14 | 28.2 | 1.26 | 3.2 |
| Paola | 62 | −12 | 30.1[c] | 1.60 | 2.5 |
| Pleasanton | 62 | −10 | 32.0 | 2.13 | 2.0 |
| Pratt | 70 | −7 | 32.5 | T. | T. |
| Republic | 64 | −11 | 25.9 | 0.06 | T. |
| Rome | 70 | −6 | 33.4 | 0.55 | T. |
| Salina | 65 | −13 | 28.6 | 0.18 | 0.7 |
| Sedan | 61 | −5 | 32.8 | 1.49 | T. |
| Toronto | 65 | −13 | 30.7 | 1.15 | 2.0 |
| Ulysses | 70[e] | −4[c] | 30.4[c] | 0.10 | 1.0 |
| Valley Falls | 54 | −14 | 26.2 | 0.56 | 2.2 |
| Viroqua | 68 | −3 | 30.6 | T. | T. |
| Wakeeney | ..... | ..... | ..... | 0.02 | 0.2 |
| Wallace | 68 | −5 | 27.9 | T. | T. |
| Walnut | 62 | −8 | 32.9 | 1.65 | T |
| Wamego*[1] | 55 | −13 | 25.9 | 0.58 | 3.5 |
| Winfield | 67 | −4 | 32.2 | 1.13 | 0.2 |
| Yates Center | 65 | −5 | 32.5 | 1.12 | 1.0 |
| *Kentucky.* | | | | | |
| Alpha | 62 | 6 | 37.2 | 3.37 | 0.5 |
| *Kentucky*—Cont'd. | | | | | |
| Anchorage | 58 | 0 | 29.8 | 2.55 | 3.5 |
| Bardstown | 62 | 2 | 32.6 | 2.85 | 2.0 |
| Beattyville | 69 | 5 | 32.2 | 3.05 | 2.5 |
| Beaver Dam | 62 | 0 | 30.6 | 2.76 | 0.5 |
| Berea | 65 | 4 | 32.4 | 3.14 | 1.5 |
| Blandville | 60 | 0 | 31.8 | 5.16 | 3.8 |
| Bowling Green | 62 | 5 | 34.6 | 2.93 | T. |
| Burnside | 65 | 8 | 35.4 | 3.61 | 1.0 |
| Cadiz | 64 | 4 | 34.4 | 2.92 | 2.0 |
| Calhoun | 61 | −2 | 32.1 | 3.02 | ..... |
| Catlettsburg | 68 | 6 | 31.9 | 2.32 | T. |
| Earlington | 63 | 2 | 31.8 | 3.46 | 1.2 |
| Edmonton | 62[e] | 5[d] | 34.9[e] | 3.81 | 1.0 |
| Falmouth | ..... | ..... | ..... | 2.88 | 3.0 |
| Fords Ferry | 63 | −9 | 33.5 | 4.71 | 6.0 |
| Frankfort | 62 | 4 | 31.4 | 2.18 | 0.5 |
| Franklin | 67 | 8 | 35.6 | 3.60 | 1.0 |
| Greensburg | 62 | 7 | 32.2 | 3.34 | 0.2 |
| Highbridge | 61 | 5 | 32.2 | 2.14 | 1.0 |
| Hopkinsville | 63 | 3 | 34.4 | 3.79 | 2.5 |
| Irvington | 59 | 3 | 31.8 | 2.58 | 1.5 |
| Jackson | 70 | 8 | 36.0 | 2.67 | T. |
| Leitchfield | 59 | 3 | 31.6 | 3.32 | 1.2 |
| Loretto | 63 | 2 | 31.6 | 2.37 | T. |
| Marrowbone | 66 | 7 | 36.4 | 2.96 | 1.0 |
| Mayfield | 61 | −2 | 35.2 | 4.17 | 1.0 |
| Maysville | 66 | 0 | 29.7 | 3.18 | 2.3 |
| Mount Sterling | 63 | 4 | 28.8 | 3.46 | 4.0 |
| Owensboro | 60 | 0 | 30.4 | 3.14 | 2.5 |
| Owenton | 59 | −2 | 28.4 | 3.21 | 4.8 |
| Paducah *a* | ..... | ..... | ..... | 4.48 | 3.0 |
| Paducah *b* | 63 | 1 | 34.0 | 4.77 | 3.0 |
| Princeton | 62 | 2 | 35.0 | 3.45 | 2.0 |
| St. John | 60 | −1 | 31.3 | 2.99 | 1.0 |
| Scott | 59 | −7 | 26.2 | 2.43 | 6.2 |
| Shelby City | 61 | 2 | 31.2 | 2.77 | 1.0 |
| Shelbyville | 60 | −1 | 29.4 | 3.45 | 7.0 |
| Taylorsville | 60 | 2 | 30.6 | 2.71 | 1.0 |
| Williamsburg | 65 | 10 | 35.2 | 2.29 | 5.8 |
| Williamstown | 56 | −3 | 28.6 | 2.59 | 3.5 |
| *Louisiana.* | | | | | |
| Abbeville | 75 | 21 | 49.5 | 3.85 | T. |
| Alexandria | 74 | 20 | 44.6 | 1.80 | 1.0 |
| Amite | 74 | 18 | 45.6 | 3.80 | |
| Baton Rouge | 77 | 21 | 48.0 | 3.30 | |
| Burnside | 75 | 19 | 50.4 | 3.82 | |
| Cameron | 72 | 25 | 49.8 | 4.39 | |
| Caspiana | 72 | 15 | 46.8 | 1.93 | |
| Clinton | 72 | 20 | 45.6 | 3.35 | |
| Collinston | 73 | 20 | 42.1 | 3.92 | 2.0 |
| Covington | 75 | 21 | 46.9 | 2.45 | |
| Donaldsonville | 79 | 21 | 51.0 | 4.58 | |
| Emilie | 74 | 21 | 48.6 | 2.81 | |
| Franklin | 76 | 23 | 50.2 | 2.75 | |
| Grand Coteau | 76 | 23 | 50.0 | 3.06 | |
| Hammond | 74 | 19 | 48.3 | 3.95 | |
| Houma | 75 | 19 | 48.6 | 3.61 | |
| Jennings | 73 | 23 | 47.7 | 2.69 | |
| Lafayette | 75 | 22 | 47.7 | 3.76 | |
| Lake Charles | 77 | 24 | 50.6 | 1.25 | |
| Lake Providence | ..... | 17 | ..... | 3.17 | 4.0 |
| Lakeside | 74 | 28 | 48.7 | 3.76 | |
| Lawrence | ..... | 32 | ..... | 2.85 | |
| Leesville | 74 | 10 | 46.6 | 2.16 | 2.0 |
| Libertyhill | 73 | 15 | 47.4 | 1.98 | 2.0 |
| Logansport | ..... | ..... | ..... | 1.77 | T. |
| Melville | 80 | 15 | 47.6 | 4.10 | |
| Minden | 70 | 18 | 44.4 | 1.40 | |
| Monroe | 71 | 19 | 45.0 | 2.12 | 3.0 |
| New Iberia | 75 | 24 | 51.8 | 3.15 | |
| Opelousas | 75 | 21 | 47.2 | 3.28 | |
| Oxford | 74 | 16 | 46.5 | 1.60 | 2.0 |
| Plain Dealing | 73 | 12 | 42.9 | 2.78 | |
| Port Eads | 72 | 37 | 56.1 | 2.72 | |
| Rayne | 79 | 23 | 48.8 | 3.82 | |
| Ruston | 72 | 16 | 44.9 | 1.72 | |
| St. Francisville | 73 | 17 | 46.0 | 1.40 | T. |
| Schriever | 79 | 18 | 48.7 | 3.69 | |
| Southern University | ..... | ..... | ..... | 3.76 | |
| Sugar Experiment Station | 74 | 27 | 51.6 | 3.25 | |
| Sugartown | 71 | 21 | 48.4 | 2.33 | |
| Venice | 80 | 25 | 54.4 | 3.29 | |
| Wallace | 76 | 19 | 49.6 | 3.04 | |
| *Maine.* | | | | | |
| Bar Harbor | 44 | −12 | 16.2 | 5.37 | 29.5 |
| Belfast | 38 | −14 | 12.4 | 4.86 | 37.0 |
| Chesuncook | ..... | ..... | ..... | 1.78 | ..... |
| Cornish | 38 | −17 | 14.3 | 3.39 | 33.2 |
| Danforth | ..... | ..... | ..... | 2.95 | 28.0 |
| Fairfield | 40 | −26 | 10.2 | 3.21 | 31.0 |
| Farmington | 35 | −29 | 9.0 | 3.52 | 31.5 |
| Gardiner | 43 | −33 | 10.0 | 4.12 | 30.8 |
| Houlton | 36 | −30 | 8.2 | 4.60 | 36.0 |
| Jackman | ..... | ..... | ..... | 2.15 | 27.0 |
| Lewiston | 38 | −26 | 11.0 | 4.26 | 32.0 |
| Madison | 47 | −20 | 11.8 | 2.28 | 22.8 |
| Mayfield | 34 | −20 | 11.4 | 3.07 | 29.0 |
| Millinocket | 41 | −32 | 8.5 | 3.35 | 27.0 |
| *Maine*—Cont'd. | | | | | |
| North Bridgton | 35 | −23 | 12.6 | 4.58 | 42.5 |
| Oquossoc | 35 | −31 | 6.4 | 2.86 | 27.0 |
| Orono | 41 | −26 | 10.2 | 3.63 | 34.0 |
| Patten | 36 | −26 | 6.3 | 2.90 | 33.0 |
| Rumford Falls | 37 | −20 | 10.4 | 2.88 | 30.8 |
| South Lagrange | 39 | −21 | 8.9 | 2.10 | 22.9 |
| The Forks | ..... | ..... | ..... | 2.95 | 30.0 |
| Thomaston | 41 | −18 | 11.6 | ..... | ..... |
| Vanburen | 37 | −33 | 3.6 | 2.76 | 29.0 |
| Vanceboro | 48 | −24 | 9.4 | 3.43 | 42.5 |
| Winslow | ..... | ..... | ..... | 2.58 | 29.0 |
| *Maryland.* | | | | | |
| Annapolis | 54 | 4 | 29.0 | 3.70 | 16.0 |
| Bachmans Valley | 50 | −17 | 23.0 | 4.67 | 17.5 |
| Boettcherville | 54 | −19 | 24.2 | 1.75 | 21.5 |
| Boonsboro | 56 | −10 | 25.0 | 2.33 | 15.5 |
| Cambridge | 60 | 3 | 29.3 | 2.68 | 8.5 |
| Charlotte Hall | 64[e] | 3[e] | 29.8[e] | ..... | ..... |
| Chase | 55 | −6 | 26.4 | 3.04 | 15.5 |
| Cheltenham | 63 | 0 | 26.7 | 2.32 | 9.0 |
| Chestertown | 57 | −2 | 26.4 | 3.34 | 15.0 |
| Chewsville | 59 | −18 | 22.0 | 1.79 | 16.5 |
| Clearspring | 50 | −5 | 22.0 | 3.49 | 24.2 |
| Coleman | 57 | −2 | 26.6 | 2.64 | 15.0 |
| Collegepark | 61 | −9 | 25.9 | ..... | ..... |
| Colora | ..... | ..... | ..... | 3.44 | 18.0 |
| Cumberland | ..... | ..... | ..... | 3.08 | 26.0 |
| Darlington | 56 | −7 | 24.0 | 3.37 | 15.0 |
| Deerpark | 56[e] | −12[e] | 21.2[e] | 3.16 | 31.6 |
| Denton | ..... | ..... | ..... | 1.47 | 12.0 |
| Easton | 58 | 3 | 28.5 | 1.47 | 4.2 |
| Fallston | 52 | −5 | 24.5 | 2.87 | 12.0 |
| Frederick | 53 | −12 | 24.4 | 2.60 | 15.0 |
| Grantsville | 60 | −20 | 21.4 | 4.10 | 34.5 |
| Greatfalls | 60 | −4 | 26.4 | 1.50 | ..... |
| Greenspring Furnace | 50 | −13 | 22.0 | 2.19 | 17.0 |
| Hancock | 50 | −17 | 23.3 | 1.96 | 16.5 |
| Harney | ..... | ..... | ..... | 2.57 | 20.5 |
| Jewell | 63 | 2 | 28.2 | 1.98 | 10.4 |
| Johns Hopkins Hospital | 57 | 1 | 27.4 | 3.63 | 18.0 |
| Laurel | 62 | −7 | 27.4 | 2.20 | ..... |
| Mount St. Marys College | 49 | −4 | 24.0 | 3.89 | 21.5 |
| New Market | 54 | −10 | 23.8 | 2.97 | 24.0 |
| Oakland | 57 | −17 | 22.3 | 2.07 | 20.0 |
| Pocomoke City | ..... | ..... | ..... | 1.07 | 4.8 |
| Prince Fredericktown | 63 | 3 | 28.5 | 1.85 | 9.2 |
| Princess Anne | 62 | 4 | 30.8 | 1.76 | 7.0 |
| Sharpsburg | 57 | −11 | 24.7 | 2.55 | 14.0 |
| Solomons | 60 | 9 | 30.2 | 1.75 | 6.5 |
| Sudlersville | 58 | −4 | 26.6 | 2.89 | 10.0 |
| Takoma Park | 60 | −3 | 24.6 | 4.06 | 22.0 |
| Van Bibber | 55 | −3 | 26.2 | 2.75 | 7.7 |
| Westernport | 52 | −8 | 23.8 | 1.85 | 15.5 |
| Woodstock | 56 | −6 | 27.0 | 2.78 | 12.8 |
| *Massachusetts.* | | | | | |
| Amherst | 40 | −26 | 14.4 | 4.74 | 23.5 |
| Bedford | 39 | −17 | 17.5 | 3.24 | 38.0 |
| Bluehill (summit) | 48 | −10 | 19.0 | 6.00 | 48.0 |
| Cambridge | 42 | −9 | 19.5 | 5.15 | ..... |
| Chestnuthill | 43 | −17 | 20.0 | 5.64 | 38.2 |
| Concord | 40 | −26 | 15.0 | 3.69 | 32.1 |
| East Templeton*[1] | 44 | −14 | 17.5 | 2.91 | 23.0 |
| Fall River | 52 | −6 | 23.6 | 5.41 | 33.0 |
| Fitchburg *a**[1] | 44 | −10 | 17.4 | 4.27 | 31.8 |
| Fitchburg *b* | 44 | −10 | 17.2 | 3.25 | 26.0 |
| Framingham | 45 | −24 | 18.3 | 4.70 | 27.2 |
| Groton | 34 | −16 | 15.6 | 4.10 | 43.5 |
| Hyannis | ..... | ..... | ..... | 5.12 | 31.0 |
| Jefferson | ..... | ..... | ..... | 4.53 | 28.0 |
| Lawrence | 42 | −23 | 17.2 | 3.91 | 42.2 |
| Leominster | ..... | ..... | ..... | 3.80 | 30.5 |
| Lowell *a* | 39 | −22 | 17.8 | 4.54 | ..... |
| Lowell *b* | 40 | −20 | 17.4 | | |
| Ludlow Center | ..... | ..... | ..... | 3.04 | 22.0 |
| Middleboro | 51 | −26 | 20.1 | 5.44 | 28.5 |
| Monson | 39 | −28 | 16.6 | 3.95 | 28.5 |
| New Bedford | 47 | −9 | 21.8 | 4.99 | 32.5 |
| Pittsfield | ..... | ..... | ..... | 2.16 | 21.0 |
| Plymouth*[1] | 50 | −4 | 24.0 | 5.44 | 26.0 |
| Princeton | ..... | ..... | ..... | 3.25 | 29.5 |
| Provincetown | 47 | 0 | 26.4 | 4.62 | 18.0 |
| Salem | ..... | ..... | ..... | 4.52 | 44.5 |
| Somerset*[1] | 46 | −19 | 19.5 | 4.68 | 27.0 |
| Sterling | ..... | ..... | ..... | 3.50 | 28.8 |
| Taunton | 48 | −35 | 19.3 | 4.49 | 19.0 |
| Webster | ..... | ..... | ..... | 3.71 | 31.5 |
| Westboro | 47 | −18 | 17.8 | 4.95 | 35.5 |
| Weston | 41 | −20 | 17.3 | 3.23 | 30.9 |
| Williamstown | 47 | −24 | 14.7 | 1.96 | 18.5 |
| Winchendon | ..... | ..... | ..... | 3.17 | 31.0 |
| Worcester | 47 | −9 | 18.5 | 3.16 | 35.8 |
| *Michigan.* | | | | | |
| Adrian | 38 | −18 | 17.0 | 2.95 | 10.0 |
| Agricultural College | 38 | −15 | 14.4 | ..... | ..... |
| Allegan | 40[e] | −11[e] | 15.8[e] | 1.20 | 8.0 |
| Alma | 37 | −24 | 12.4 | 2.04 | 17.0 |
| Ann Arbor | 38 | −11 | 15.4 | 2.51 | 11.0 |
| Annpere | 39 | −18 | 11.4 | 2.17 | 13.7 |

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

| Stations. | Temperature. (Fahrenheit.) | | | Precipitation. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Rain and melted snow. | Total depth of snow. |
| | ° | ° | ° | *Ins.* | *Ins.* |
| *Michigan*—Cont'd. | | | | | |
| Arbela | 37 | −17 | 13.4 | 4.03 | 29.0 |
| Baldwin | 31 | −32 | 11.0 | | |
| Ball Mountain | 38 | −18 | 14.8 | 2.47 | 20.2 |
| Baraga | 38 | −28 | 11.4 | | |
| Battlecreek | 39 | −14 | 13.2 | 1.85 | 10.5 |
| Bay City | 38 | −18 | 14.4 | 1.30 | 13.0 |
| Benzonia | 33 | −10 | 13.8 | 1.61 | 16.1 |
| Berlin | 37 | −18 | 13.0 | 2.38 | 22.6 |
| Berrien Springs | 41 | −15 | 17.8 | 3.37 | 18.0 |
| Big Rapids | 34 | −25 | 11.9 | 1.40 | 14.0 |
| Birmingham | 42 | −15 | 13.9 | 1.83 | 14.5 |
| Calumet | 33 | −14 | 11.4 | 2.68 | 33.5 |
| Carsonville | 38[f] | −18[f] | 12.8[f] | 0.80 | 8.0 |
| Cassopolis | 40 | −15 | 16.7 | 3.71 | 11.0 |
| Charlevoix | 33 | −22 | 13.3 | 1.40 | 14.0 |
| Charlotte[k] | 38 | −13 | 14.4 | 1.00 | 10.0 |
| Chatham | 33 | −31 | 10.4 | 2.02 | 20.2 |
| Cheboygan | 31 | −20 | 12.5 | 0.50 | 5.0 |
| Clinton | 40 | −15 | 15.6 | 3.14 | 12.4 |
| Coldwater | 39 | −15 | 16.1 | 1.85 | 14.5 |
| Dundee | 39 | −14 | 15.5 | 5.37 | 23.3 |
| East Tawas | 37 | −12 | 14.4 | 1.84 | 18.0 |
| Eloise | 38 | −15 | 14.8 | 3.98 | 24.6 |
| Ewen | 34 | −40 | 3.8 | 0.60 | 6.0 |
| Fennville | 40 | − 6 | 17.4 | 2.51 | 20.0 |
| Fitchburg | 38 | −20 | 13.4 | 3.38 | 25.0 |
| Flint | 36[e] | −19[e] | 13.1[e] | 1.91 | 15.5 |
| Gaylord | 40 | −21 | 12.8 | 0.65 | 6.5 |
| Gladwin[l] | 36 | −22 | 11.4 | 0.60 | 6.0 |
| Grand Haven | 36 | − 6 | 18.1 | 0.78 | 5.7 |
| Grand Marais | 33 | − 8 | 13.2 | 2.75 | 27.5 |
| Grape | 38 | −15 | 16.2 | 4.17 | 16.9 |
| Grayling | 34 | −22 | 9.2 | 1.30 | 13.0 |
| Hagar | 42 | − 8 | 17.6 | 5.73 | 29.9 |
| Harbor Beach | 38 | −17 | 14.6 | 0.80 | 8.0 |
| Harrisville | 34 | −18 | 12.8 | 2.13 | 21.8 |
| Hart | 39 | −15 | 15.3 | 3.20 | 32.0 |
| Hastings | 38 | −17 | 14.4 | 2.23 | 17.1 |
| Hayes | 38 | −19 | 11.8 | 2.90 | 29.0 |
| Highland | | | | 2.79 | 17.0 |
| Hillsdale | 39 | −19 | 14.2 | 4.07 | 20.0 |
| Humboldt | 31 | −41 | 3.9 | 1.30 | 13.0 |
| Ionia[k] | 40 | −24 | 12.9 | | |
| Iron Mountain | 33 | −25 | 8.8 | 0.40 | 4.0 |
| Iron River | 33 | −37 | 4.6 | 0.70 | 9.0 |
| Ironwood | 32 | −35 | 6.2 | 3.20 | 32.0 |
| Ishpeming | 32 | −26 | 7.6 | 1.40 | 14.0 |
| Ivan[f] | 27 | −29 | 6.8 | 0.85 | 8.5 |
| Jackson | 40 | −11 | 16.4 | 2.80 | 16.0 |
| Jeddo | 36 | −20 | 13.8 | 1.98 | 19.8 |
| Lake City | 29 | −19 | 10.2 | 0.80 | 8.0 |
| Lansing | 39 | −14 | 14.2 | 2.82 | 18.3 |
| Lapeer | 40[e] | −17[b] | 14.4[d] | | |
| Mackinaw | 33 | −17 | 9.6 | 0.80 | 8.0 |
| Mancelona | 30 | −18 | 11.5 | 2.20 | 22.0 |
| Manistee[k] | 35 | − 6 | 17.6 | 1.45 | 14.5 |
| Marine City | 38 | −17 | 16.4 | 4.00 | 31.5 |
| Menominee | 36 | −26 | 11.4 | 0.35 | 3.5 |
| Midland | 32 | | | | 14.0 |
| Mio | 33 | −18 | 10.3 | 0.73 | 7.8 |
| Mount Clemens | 37 | −14 | 15.1 | | |
| Mount Pleasant | 40 | −21 | 13.7 | 1.90 | 19.0 |
| Muskegon | 37 | −10 | 17.6 | 1.57 | 15.5 |
| Newberry | 30 | −28[e] | 10.8[e] | 1.70 | 17.0 |
| Old Mission | 33 | − 4 | 14.9 | 1.32 | 15.4 |
| Olivet | 38 | −12 | 15.1 | 2.99 | 16.4 |
| Omer | | | | 0.30 | 3.0 |
| Onaway | 30 | −18 | 11.1 | | |
| Ovid | 39 | −18 | 14.4 | 2.00 | 18.0 |
| Owosso | 40 | −16 | 14.8 | 0.80 | 8.0 |
| Petoskey | 33 | −16 | 12.7 | 1.12 | 11.4 |
| Plymouth[g] | 36 | −15 | 16.5 | 1.50 | 15.0 |
| Port Austin | 39 | −12 | 14.2 | 2.25 | 22.5 |
| Powers | 35 | −26 | 11.7 | 0.34 | 3.4 |
| Reed City | 35 | −18 | 12.6 | | 5.0 |
| Roscommon[f] | 32 | −26 | 8.2 | 1.20 | 12.0 |
| Saginaw (W. S.) | 38 | −15 | 14.6 | 1.43 | 15.8 |
| St. Ignace | 31 | −23 | 10.8 | 1.05 | 14.0 |
| St. Johns | 39 | −16 | 15.6 | | |
| St. Joseph | 37 | − 7 | 14.8 | 3.30 | 23.0 |
| Slocum | 37 | −23 | 12.6 | | |
| South Haven | 39 | − 3 | 17.6 | 2.42 | 10.0 |
| Thomaston | 35 | −40 | 5.0 | 0.50 | 5.0 |
| Thornville | 36 | −16 | 14.8 | 2.90 | 33.0 |
| Traverse City | 35 | −15 | 12.8 | 0.40 | 4.0 |
| Vans Harbor | | | | 1.20 | 12.0 |
| Vassar | 38 | −21 | 12.6 | 1.85 | 16.0 |
| Wasepi | 38 | −17 | 14.8 | 3.50 | 15.0 |
| Webberville | 39 | −22 | 13.5 | 4.20 | 42.0 |
| West Branch | 24[e] | −18[e] | 7.6[e] | 1.00 | 10.0 |
| Wetmore | 28 | −29[e] | 7.1 | 1.53 | 15.3 |
| Whitefish Point | 32 | −24 | 10.3 | 1.34 | 13.4 |
| Ypsilanti | 37 | −16 | 14.3 | 4.34 | 22.6 |
| *Minnesota.* | | | | | |
| Albert Lea | 38 | −34 | 5.8 | 0.60 | 6.0 |
| Alexandria | | −39 | | 0.40 | 4.0 |
| Angus | 34 | −45 | −0.8 | | |
| Ashby | 34 | −35 | 5.9 | 0.24 | 3.0 |
| *Minnesota*—Cont'd. | | | | | |
| Beardsley | 40 | −37 | 6.4 | 0.52 | 4.5 |
| Beaulieu | 35 | −42 | 2.4 | 0.13 | 0.8 |
| Bemidji | 35 | −39 | 2.2 | 0.18 | |
| Bird Island | 38 | −35 | 6.4 | 0.39 | 4.0 |
| Blooming Prairie | 38 | −31 | 6.8 | 0.27 | 2.8 |
| Brainerd | 37 | −40 | 0.6 | 0.40 | 4.0 |
| Caledonia | 36 | −35 | 8.6 | 0.54 | 7.0 |
| Collegeville | 36 | | | 0.31 | 4.8 |
| Crookston | 35 | −38 | −0.2 | 0.30 | 3.0 |
| Deephaven | | | | 0.37 | 5.0 |
| Faribault | 38 | −31 | 6.4 | 0.33 | 4.4 |
| Farmington | 36 | −34 | 5.5 | 0.50 | 5.5 |
| Fergus Falls | 37 | −38 | 4.7 | 0.42 | 4.2 |
| Floodwood | 37 | −40 | 1.8 | | |
| Glencoe | 37 | −32 | 7.0 | 0.68 | 6.8 |
| Grand Meadow | 31 | −30 | 6.4 | 0.21 | 6.5 |
| Hallock | 36 | −44 | −2.6 | 0.18 | 2.0 |
| Lake Winnibigoshish | 33 | −42 | −1.7 | 0.35 | 3.3 |
| Leech | 28 | −42 | −1.0 | 0.13 | 2.3 |
| Long Prairie | 36 | −40 | 4.4 | 0.14 | 1.6 |
| Luverne | 36 | −27 | 8.8 | 0.40 | 4.0 |
| Lynd | 38 | −32 | 8.2 | 0.25 | 2.1 |
| Mapleplain | 39 | −35 | 5.6 | 0.97 | 11.5 |
| Milaca | 37 | −40 | 4.0 | 0.33 | 7.0 |
| Milan | 40 | −35 | 6.0 | 0.85 | 8.5 |
| Minneapolis[1] | 37* | −34 | 6.0 | 0.43 | 5.8 |
| Montevideo | 39 | −35 | 7.7 | 0.43 | |
| Morris | 36 | −36 | 5.9 | 0.40 | 4.0 |
| Mount Iron | 35 | −45 | 0.5 | 0.50 | 5.0 |
| New London | 36 | −38 | 4.2 | 0.15 | 2.2 |
| New Richland | 40 | −30 | 8.4 | 0.15 | 1.5 |
| New Ulm | 38 | −32 | 7.6 | 1.00 | 10.0 |
| Park Rapids | 35 | −45 | −0.6 | 0.30 | 3.0 |
| Pine River | 38 | −40 | −0.1 | 0.08 | 2.0 |
| Pleasant Mounds | 37 | −30 | 9.6 | 0.25 | 2.5 |
| Pokegama Falls | 36 | −57 | −4.2 | 0.13 | 1.5 |
| Redwing *a* | | | | 0.31 | 6.0 |
| Redwing *b* | 37 | −31 | 7.6 | 0.34 | 4.5 |
| Reeds | | | | 0.14 | 3.7 |
| Rolling Green | 39 | −28 | 8.8 | 0.70 | 7.0 |
| St. Charles | 38[c] | −32[c] | 6.3[c] | 0.90 | 9.0 |
| St. Peter | 40 | −32 | 9.4 | 0.25 | 2.5 |
| Sandy Lake Dam | 36 | −42 | −0.4 | 0.31 | 4.6 |
| Shakopee | 38 | −33 | 6.8 | 1.00 | 10.0 |
| Tower | 29 | −42 | −8.4 | 0.10 | 1.0 |
| Two Harbors | 39 | −34 | 6.8 | 0.09 | 0.2 |
| Wabasha | 38 | −30 | 8.0 | 0.23 | 2.8 |
| Willow River | 38 | −41 | 2.8 | 0.41 | 4.3 |
| Winnebago | 43 | −29 | 11.7 | 0.39 | 5.3 |
| Winona | 40 | −30 | 9.2 | 0.26 | 3.5 |
| Wyoming | | | | 0.73 | 7.3 |
| Zumbrota | 37 | −32 | 7.2 | 0.75 | |
| *Mississippi.* | | | | | |
| Aberdeen | 65 | 12 | 38.8 | 2.88 | 2.0 |
| Agricultural College | 67 | 10 | 41.0 | 3.23 | 4.5 |
| Austin | 65 | 8 | 39.8 | 4.52 | T. |
| Batesville | 67 | 10 | 39.4 | 2.63 | 0.1 |
| Bay St. Louis | 70 | 26 | 49.3 | 2.42 | |
| Biloxi | 66[e] | 28[e] | 50.5[e] | 2.64 | |
| Booneville | 62 | 13 | 38.4 | 3.74 | T. |
| Canton | 68 | 14 | 44.0 | 2.08 | 5.0 |
| Columbus | 65 | 13 | 39.1 | 4.39 | 4.5 |
| Corinth | 60 | 12 | 36.7 | 3.33 | T. |
| Crystal Springs | 70 | 9 | 42.9 | 2.66 | 11.0 |
| Duck Hill | 67 | 14 | 40.8 | 2.96 | 0.2 |
| Edwards | 69 | 15 | 43.6 | 2.23 | 6.5 |
| Fayette | 72 | 14 | 43.4 | 3.42 | 8.0 |
| Fayette (near) | | | | 2.47 | 6.0 |
| Greenville *a* | 67 | 16 | 43.6 | 2.47 | T. |
| Greenville *b* | 69 | 15 | 42.0 | 2.57 | T. |
| Greenwood | 69 | 18 | 44.5 | 3.30 | T. |
| Hattiesburg | 75[l] | 18 | 48.0[e] | 3.69 | T. |
| Hazlehurst | 72 | 12 | 43.4 | 2.52 | 7.0 |
| Hernando | 64 | 9 | 39.0 | 2.22 | 1.0 |
| Holly Springs | 62 | 8 | 36.4 | 3.97 | 1.5 |
| Indianola | 72 | 16 | 42.2 | 5.42 | T. |
| Jackson | 70 | 3 | 42.6 | 3.80 | 11.7 |
| Kosciusko | 67 | 16 | 40.2 | 3.80 | 6.0 |
| Lake | 69 | 5 | 40.5 | 3.77 | 9.8 |
| Lake Como | 74 | 18 | 45.0 | 3.22 | 2.5 |
| Leakesville | 72 | 19 | 46.6 | 4.26 | T. |
| Louisville | 67 | 8 | 42.4 | 3.55 | 8.0 |
| McNeill | 70 | 22 | 48.2 | 4.04 | T. |
| Macon | 67 | 18 | 40.2 | 3.17 | 6.0 |
| Magee | 79 | 11 | 43.8 | 2.56 | 6.0 |
| Magnolia | 72 | 18 | 47.0 | 3.77 | 2.0 |
| Natchez | 72 | 21 | 47.8 | 2.25 | |
| Okolona | 64 | 13 | 39.9 | 3.52 | 0.8 |
| Patmos | | | | 2.90 | 6.0 |
| Pearlington | 74 | 22 | 48.6 | 2.69 | |
| Pittsboro | 66[f] | 12 | 41.0[e] | 2.45 | T. |
| Pontotoc | 64 | 12 | 39.8 | 2.95 | 1.2 |
| Poplarville[k] | 70 | 24 | 48.4 | | |
| Port Gibson | 73 | 13 | 44.4 | 2.16 | 7.5 |
| Ripley | 65 | 8 | 36.5 | 3.90 | 3.0 |
| Shoccoe | 69 | 12 | 43.1 | 2.61 | 8.5 |
| Stonington | | | | 2.35 | 8.0 |
| Suffolk | 71 | 12 | 45.4 | 3.43 | 6.5 |
| *Mississippi*—Cont'd. | | | | | |
| Swartwout | 70 | 24 | 48.4 | 3.62 | |
| Thornton | 70 | 18 | 43.7 | 1.60 | 6.0 |
| Tupelo | 64 | 13 | 38.9 | 3.02 | 1.0 |
| University | 66 | 11 | 40.8 | 3.07 | 0.3 |
| Utica | 74 | | | 2.34 | 9.0 |
| Walnutgrove | 69[c] | 8[c] | 44.4[c] | 3.55 | 10.0 |
| Watervalley | 65 | 12 | 41.0 | | |
| Waynesboro | 73 | 18 | 42.4 | 4.80 | 0.5 |
| Woodville | 71 | 22 | 46.9 | 3.38 | 3.0 |
| Yazoo City | 70 | 17 | 42.2 | 2.57 | 5.0 |
| *Missouri.* | | | | | |
| Appleton City | 63 | −12 | 30.0 | 2.26 | |
| Arthur | 65 | −10 | 32.1 | 1.79 | 1.0 |
| Avalon | 49[e] | −18 | 23.3[e] | 2.20 | 12.0 |
| Bethany | 49 | −22 | 20.8 | 2.59 | 10.7 |
| Birchtree | 61 | − 5 | 33.3 | 3.52 | 5.7 |
| Blue Springs | 58 | −13 | 26.8 | 0.80 | 0.9 |
| Boonville | | | | 2.35 | 3.6 |
| Brunswick | 54 | −17 | 23.3 | 2.01 | 14.8 |
| Carrollton | 54 | −16 | 26.7 | 2.30 | 2.7 |
| Caruthersville | 61 | 3 | 37.4 | 4.03 | 0.8 |
| Conception | 51 | −18 | 20.4 | 1.97 | 11.0 |
| Darksville | 52 | −17 | 23.8 | 2.84 | 7.1 |
| Dean | 66 | −10 | 34.2 | 4.47 | 0.6 |
| Desoto | 58 | − 9 | 28.4 | 2.50 | 9.3 |
| Downing | | | | 3.94 | 10.5 |
| Edgehill | 57 | − 4 | 30.8 | 2.98 | 5.7 |
| Eightmile | | | | 1.45 | 2.0 |
| Fairport | | | | 1.99 | 6.7 |
| Fayette | 54 | −15 | 22.8 | 2.01 | 6.8 |
| Fulton | 60 | −15 | 26.4 | 3.28 | 13.5 |
| Gano | 62 | − 9 | 31.2 | 2.78 | 9.0 |
| Glasgow | 56 | −13 | 23.8 | 2.29 | 7.8 |
| Gorin | | | | 4.20 | 11.4 |
| Grant City | 51 | −20 | 20.1 | 2.61 | 7.5 |
| Halfway | 65 | −12 | 33.1 | 3.18 | 7.0 |
| Harrisonville | 63 | −11 | 26.3 | 1.09 | 2.0 |
| Hazlehurst | | | | 2.08 | 12.5 |
| Hermann | | | | 3.14 | 10.4 |
| Houston | 60 | − 7 | 31.8 | 2.90 | 4.6 |
| Huntsville | 55 | −16 | 24.3 | 2.32 | 10.3 |
| Ironton | 58 | −10 | 29.4 | 3.08 | 8.5 |
| Jackson | 64 | − 7 | 32.9 | 3.80 | 10.2 |
| Jefferson City | 65 | −14 | 26.8 | 3.08 | 11.5 |
| Joplin | 65 | − 5 | 35.8 | 2.02 | 1.5 |
| Kidder | 49 | −15 | 22.1 | 1.36 | 5.2 |
| Koshkonong | 61 | − 3 | 33.4 | 4.14 | 5.0 |
| Lamar | 65 | − 9 | 32.6 | 1.82 | 2.0 |
| Lamonte | | | | 2.10 | 1.0 |
| Lebanon | 62 | −10 | 30.7 | 3.25 | 5.5 |
| Lexington | 57 | −12 | 27.0 | 1.53 | 2.5 |
| Liberty | 52 | −11 | 26.0 | 1.02 | 2.6 |
| Lockwood | | | | 2.53 | 0.5 |
| Louisiana | 55 | −20 | 22.0 | 3.91 | 16.4 |
| Macon | 52 | −16 | 22.6 | 3.28 | 8.5 |
| Marblehill | 58 | −11 | 32.1 | 3.70 | 9.3 |
| Marshall | 58 | −16 | 25.7 | 1.91 | 4.1 |
| Maryville | 51 | −15 | 17.7 | 3.20 | 9.0 |
| Mexico | 61 | −14 | 24.0 | 2.03 | 9.4 |
| Miami*[3] | 54 | −12 | 23.4 | 1.60 | 5.4 |
| Mineral Springs | 64 | − 7 | 33.5 | 4.35 | 2.5 |
| Monroe City | 49 | −19 | 20.7 | 2.27 | 9.6 |
| Montreal | 63 | −21 | 29.4 | 4.44 | 7.8 |
| Mountaingrove | 59 | − 9 | 31.6 | 3.28 | 3.0 |
| Mount Vernon | 66 | − 9 | 33.2 | 4.08 | 1.0 |
| Neosho | 65 | − 5 | 34.5 | 5.29 | 3.0 |
| Nevada | | | | 1.30 | 1.5 |
| New Haven | 64 | − 7 | 28.4 | 4.72 | 19.5 |
| New Madrid | | | | 5.27 | |
| New Palestine | | | | 1.40 | 2.5 |
| Oakfield | 61 | −10 | 28.2 | 3.43 | 12.9 |
| Olden | 63 | − 5 | 34.2 | 3.31 | 4.5 |
| Oregon | 52 | −15 | 22.1 | 2.33 | 11.2 |
| Palmyra*[5] | 50 | −16 | 19.9 | 3.36 | 15.0 |
| Pine Hill | | | | 2.93 | 5.1 |
| Princeton | 50 | −19 | 20.1 | 2.69 | 11.9 |
| Protem | 66 | − 2 | 35.6 | 4.88 | 5.3 |
| Rockport | | | | 1.95 | 7.0 |
| Rolla | | | | 4.86 | 11.8 |
| St. Charles | 59 | − 9 | 26.5 | 4.27 | 17.8 |
| St. Joseph | | | | 1.42 | 5.0 |
| Sarcoxie | | | | 3.44 | 2.0 |
| Sedalia | 63 | −14 | 28.3 | 2.20 | 4.0 |
| Seymour | 60 | −10 | 31.4 | 3.64 | 5.2 |
| Shelbina | | | | 2.43 | 7.5 |
| Sikeston | 60 | 1 | 35.0 | 4.52 | 3.0 |
| Steffenville | 56 | −20 | 21.1 | 3.69 | 15.5 |
| Sublett | | | | 4.07 | 10.5 |
| Trenton | 50 | −16 | 22.0 | 2.61 | 11.0 |
| Unionville | 50 | −16 | 18.0 | 3.96 | 11.8 |
| Warrensburg | 62 | −14 | 28.4 | 1.49 | 6.6 |
| Warrenton | 62 | −12 | 22.8 | 3.57 | 11.8 |
| Wheatland | | | | 2.02 | 5.2 |
| Willowsprings | 61 | − 9 | 31.6 | 3.10 | 3.0 |
| Zeitonia | 58 | − 8 | 31.2 | 3.31 | 11.0 |
| *Montana.* | | | | | |
| Adel | 49 | − 8 | 25.4 | 1.00 | 10.0 |
| Anaconda | 52 | 3 | 27.0 | 0.60 | 6.0 |

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

| Stations. | Temperature. (Fahrenheit.) | | | Precipitation. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Rain and melted snow. | Total depth of snow. |
| *Montana*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Augusta | 54 | −10 | 27.4 | 0.21 | 2.5 |
| Billings | 58 | 3 | 32.0 | | |
| Boulder | 46 | 1 | 25.6 | 0.46 | 6.7 |
| Bozeman | 48 | 4 | 22.6 | 0.85 | 8.5 |
| Butte | 44 | 4 | 26.6 | 1.40 | 14.0 |
| Canyon Ferry | 48 | 0 | 24.4 | 0.30 | 3.2 |
| Chinook | 57 | −13 | 18.4 | 0.16 | |
| Columbia Falls | 48 | 4 | 27.0 | 3.13 | 20.7 |
| Crow Agency | 49 | −9 | 25.9 | 0.60 | 6.0 |
| Culbertson | 42 | −34 | 6.4 | 0.34 | 4.0 |
| Cutbank | 52 | −32 | 20.6 | 0.11 | |
| Dayton | 49 | 5 | 27.1 | 1.03 | 10.3 |
| Deerlodge | 45 | 1 | 23.8 | | |
| Dillon | 50 | −8 | 25.6 | 0.64 | 6.6 |
| Ekalaka | 45 | −24 | 17.9 | 1.00 | 10.0 |
| Fort Benton | 50 | −8 | 24.6 | | |
| Fort Harrison | 50 | −1 | 25.2 | | |
| Glasgow | 50 | −28 | 12.3 | 1.50 | |
| Glendive | 45 | −30 | 11.7 | 1.45 | 14.5 |
| Greatfalls | 52 | −7 | 29.4 | 0.17 | 1.7 |
| Hamilton | 52 | 10 | 32.4 | 0.07 | 2.0 |
| Lamedeer | 56 | −19 | 24.9 | 2.10 | 14.0 |
| Lewistown | 56 | −10 | 24.7 | 0.92 | 9.2 |
| Livingston | 54 | 1 | 28.9 | 0.21 | 4.0 |
| Marysville | 41 | −4 | 24.0 | 2.62 | 29.0 |
| Missoula | 47[b] | 7[c] | 28.4[c] | | |
| Ovando | 43 | −5 | 21.0 | 1.59 | 24.2 |
| Parrot * | 48 | 1 | 28.6 | | |
| Philipsburg | 51 | 4 | 26.6 | 0.23 | 2.3 |
| Plains | 47 | 19 | 31.7 | 0.80 | 8.0 |
| Poplar | 47 | −28 | 10.1 | 1.05 | 10.5 |
| Redlodge | 54 | −4 | 23.8 | 0.71 | 15.5 |
| Ridgelawn | 43 | −28 | 8.0 | 0.55 | 5.5 |
| St. Pauls | | −18 | | 0.18 | 7.5 |
| St. Peter | 46 | −10 | 26.2 | 0.18 | 5.0 |
| Springbrook | 44 | −24 | 14.6 | 1.17 | 11.7 |
| Toston | 53 | 0 | 27.5 | | |
| Troy | 50 | 5 | 29.2 | 2.86 | 19.0 |
| Two Dot | 54 | −13 | 27.5 | 1.00 | 11.0 |
| Utica | 51 | −9 | 24.8 | 0.18 | 2.5 |
| Wibaux | 48 | −32 | 13.6 | 1.00 | 10.0 |
| Wolf Creek | 49 | −2 | 29.0 | 0.42 | 6.3 |
| Wolsey | 45[c] | −18[c] | 16.7[c] | 2.36 | 45.5 |
| Yale | 57 | −15 | 24.9 | 1.10 | 11.0 |
| *Nebraska.* | | | | | |
| Agate | 59 | −27 | 21.7 | 0.15 | 5.0 |
| Agee *[1] | 54 | −21 | 17.1 | 0.59 | 4.9 |
| Albion | | −18 | | 0.35 | 3.5 |
| Alliance | 63 | −16 | 25.1 | 0.18 | 1.8 |
| Alma | 62 | −11 | 27.0 | 0.09 | 0.9 |
| Ansley | 60 | −16 | 24.0 | 0.14 | 1.5 |
| Arapahoe | | | | T. | T. |
| Arcadia | | | | T. | T. |
| Ashland *a* | 57 | −14 | 21.0 | 0.50 | 1.9 |
| Ashland *b* | | | | 0.60 | 3.6 |
| Ashton | | | | 0.21 | 1.8 |
| Auburn | 58 | −14 | 22.5 | 2.29 | 5.4 |
| Aurora | 52[i] | −14[i] | 23.3[i] | 0.17 | 1.2 |
| Bartley | 60 | −10 | 27.0 | 0.15 | 1.5 |
| Beatrice | 60 | −12 | 23.5 | 0.90 | 0.5 |
| Beaver | 61 | −6 | 28.6 | 0.01 | T. |
| Bellevue | | | | 0.97 | 8.3 |
| Benkleman | | | | 0.29 | 2.2 |
| Blair | 53 | −18 | 18.0 | 0.21 | 3.1 |
| Bluehill | | | | 0.15 | 1.5 |
| Bradshaw | | | | 0.17 | 1.7 |
| Bridgeport | 62 | −15 | 25.0 | 0.30 | 3.0 |
| Brokenbow | 60 | −12 | 25.4 | 0.10 | 1.0 |
| Burwell | | | | 0.95 | 9.5 |
| Callaway | 60 | −12 | 24.3 | 0.64 | T. |
| Central City | | | | 0.35 | 3.5 |
| Chester | | | | 0.25 | 1.5 |
| Cody | | | | 0.53 | 5.3 |
| Columbus | 57 | −13 | 20.6 | 0.08 | 1.8 |
| Crete | 59 | −14 | 23.2 | 0.54 | 2.9 |
| Crookston | | | | 0.35 | 6.5 |
| Culbertson | 64 | −15 | 27.6 | 0.09 | 1.0 |
| Curtis | | −9 | | 0.05 | 0.5 |
| David City | 55 | −16 | 21.0 | 0.80 | 5.8 |
| Dawson | 58 | −12 | 23.4 | 0.52 | 4.5 |
| Edgar | | | | 0.17 | 1.7 |
| Ericson | | | | 0.85 | 8.5 |
| Ewing | | | | 0.02 | T. |
| Fairbury | 66 | −15 | 23.2 | 0.64 | 1.5 |
| Fairmont | 60 | −15 | 22.0 | 0.59 | 2.0 |
| Fort Robinson | | −18 | | 0.20 | 2.0 |
| Franklin | 64 | −16 | 26.2 | 0.10 | 1.0 |
| Fremont | 54 | −18 | 18.6 | 0.27 | 2.5 |
| Fullerton | | | | 0.25 | 2.5 |
| Geneva | 61 | −14 | 25.0 | 0.22 | 0.6 |
| Genoa (near) | 57 | −15 | 21.4 | 0.14 | 2.0 |
| Gering | 63 | −16 | 27.4 | 0.18 | 6.0 |
| Gordon | | | | 0.49 | 4.9 |
| Gothenburg | 62 | −10 | 25.8 | 0.18 | 1.8 |
| Grand Island *b* | 67 | −12 | 24.7 | 0.20 | 1.1 |
| Grant | | | | 0.05 | 0.5 |
| Greeley | | | | 0.15 | 1.5 |
| Guide Rock | | | | 0.05 | 0.5 |
| *Nebraska*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Haigler | | | | 0.02 | 0.2 |
| Halsey | 61 | −16 | 24.3 | 0.22 | |
| Hartington | 48 | −21 | 16.5 | 0.50 | 5.0 |
| Harvard | 59 | −15 | 21.8 | 0.05 | 0.5 |
| Hastings *[1] | 58 | −12 | 23.5 | 0.15 | 1.3 |
| Hayes Center | | | | 0.22 | 2.0 |
| Hay Spring | 58 | −13 | 22.0 | 0.49 | 5.0 |
| Hebron | 63 | −12 | 24.5 | 0.37 | 1.2 |
| Hickman | | | | 0.17 | 1.7 |
| Holbrook | | | | T. | T. |
| Holdrege | 59 | −10 | 27.0 | 0.18 | 1.8 |
| Holly | | | | 1.30 | 13.0 |
| Hooper *[1] | 52 | −12 | 19.0 | 0.27 | 3.5 |
| Imperial | 69 | −9 | 26.4 | 0.06 | 0.8 |
| Johnstown | | | | 0.20 | 2.2 |
| Kearney | 61 | −10 | 25.8 | 0.21 | 2.1 |
| Kennedy | 60 | −16 | 23.8 | 1.20 | 12.0 |
| Kimball | 73 | −12 | 26.2 | 0.05 | 0.5 |
| Kirkwood | 56 | −20 | 20.6 | 0.71 | 6.1 |
| Leavitt | 56 | −17 | 19.2 | 0.17 | 0.7 |
| Lexington | 62 | −10 | 24.2 | 0.39 | 3.0 |
| Lockridge | 60 | −18 | 22.7 | 0.28 | 4.3 |
| Lodgepole | 64 | −12 | 26.2 | T. | T. |
| Loup | 60 | −13 | 21.6 | T. | T. |
| Lynch | 56 | −20 | 19.8 | 0.53 | 2.0 |
| McCook | | | | 0.20 | 2.0 |
| McCool Junction | | | | 0.10 | |
| Madison | 54 | −15 | 19.8 | 0.20 | 3.0 |
| Madrid | 62 | −11 | 25.2 | T. | T. |
| Marquette | | | | 0.20 | 1.0 |
| Mason | | | | 0.25 | 2.5 |
| Minden | 61 | −10 | 24.6 | 0.06 | 1.1 |
| Monroe | | | | 0.16 | 2.1 |
| Nebraska City *c* | 55 | −16 | 20.8 | 1.10 | 6.0 |
| Nemaha | | | | 1.25 | 2.5 |
| Norfolk | 55 | −22 | 16.8 | 0.54 | 7.4 |
| North Loup | 61 | −17 | 21.2 | 0.17 | 1.7 |
| Oakdale | 54 | −16 | 17.2 | 0.25 | 2.4 |
| Odell | | | | 0.50 | 0.5 |
| Ord | | | | 0.18 | |
| Palmer | | | | 0.40 | 5.0 |
| Pawnee City | 59 | −13 | 24.0 | 1.27 | 2.2 |
| Plattsmouth *b* | | −15 | | 0.54 | 5.4 |
| Purdum | 59 | −19 | 21.8 | 0.40 | 4.0 |
| Ravenna *a* | 62 | −12 | 23.4 | 0.16 | 1.6 |
| Redcloud | | | | 0.07 | 0.7 |
| Republican | | | | 0.05 | 0.5 |
| Rulo | | | | 1.78 | 6.0 |
| St. Libory | | | | 0.30 | 1.5 |
| St. Paul | 62 | −13 | 24.1 | 0.24 | 1.0 |
| Salem | | | | 0.97 | 4.5 |
| Santee | 51 | −20 | 17.9 | 0.56 | 4.9 |
| Schuyler | | | | 0.65 | 6.0 |
| Seward | 54[h] | −18 | 23.0[d] | 0.17 | 1.7 |
| Smithfield | | | | 0.00 | |
| Spragg | | | | 0.40 | 4.0 |
| Springview | 54 | −20 | 21.1 | 0.40 | 4.0 |
| Stanton | 49 | −18 | 17.5 | 0.40 | 4.0 |
| Strang | | | | 0.05 | 0.5 |
| Stratton | | | | 0.12 | |
| Superior | 60 | −12 | 23.6 | 0.15 | 1.5 |
| Syracuse | | | | 1.25 | 7.5 |
| Tablerock | | | | 1.56 | 3.9 |
| Tecumseh *c* | | | | 1.16 | 4.3 |
| Tekamah | 56 | −18 | 19.3 | 0.96 | 8.0 |
| Turlington | 56 | −15 | 21.2 | 1.79 | 14.0 |
| University Farm | 59 | −14 | 22.8 | 0.51 | 6.0 |
| Wahoo | | | | 0.38 | 2.0 |
| Wakefield | 49 | −20 | 16.6 | 0.55 | 5.5 |
| Wallace | | | | 0.45 | 2.0 |
| Wauneta | | | | 0.07 | T. |
| Weeping Water | | | | 1.36 | 11.2 |
| Westpoint | 51 | −18 | 18.4 | 0.20 | 1.8 |
| Wilber | | | | 0.70 | |
| Wilsonville | | | | T. | T. |
| Winnebago | 46 | −22 | 16.3 | 0.20 | 3.0 |
| Wisner | | | | 0.61 | 5.4 |
| Wymore | | | | 0.86 | |
| York | 55 | −14 | 23.2 | 0.08 | 0.5 |
| *Nevada.* | | | | | |
| Amos | 51 | 1 | 25.0 | 0.60 | 2.5 |
| Austin | 46 | 4 | 26.0 | 1.01 | |
| Battle Mountain | 61 | 0 | 30.0 | 1.10 | 11.0 |
| Belmont | 50 | 3 | 24.7 | 0.08 | 2.0 |
| Beowawe *[1] | 46 | −10 | 21.2 | 0.45 | 4.5 |
| Candelaria | 53 | 8 | 33.6 | T. | T. |
| Carlin *[1] | 45 | −4 | 18.9 | 0.18 | 1.0 |
| Carson City | 60 | −5 | 31.2 | 0.54 | 7.6 |
| Cranes Ranch | | | | 0.87 | |
| Dyer | 58 | −3 | 29.8 | T. | |
| Elko | 52 | −22 | 21.2 | 1.70 | 17.0 |
| Ely | 58 | −6 | 25.4 | 0.50 | 6.2 |
| Fallon | 56 | 0 | 26.9 | T. | T. |
| Glenbrook | | | | 0.35 | |
| Golconda *[1] | 47 | 2 | 26.9 | 0.10 | 1.0 |
| Hawthorne | 54 | 8 | 29.9 | T. | |
| Humboldt | 58 | −2 | 29.0 | 0.40 | 4.5 |
| Lee | | | | 2.07 | 21.0 |
| *Nevada*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Lewers Ranch | 60 | 0 | 32.8 | 2.28 | 16.0 |
| Lovelocks *[1] | 50 | 13 | 27.4 | T. | |
| Martins | 74 | −1 | 34.9 | 0.20 | 2.0 |
| Mill City *[1] | 48 | 0 | 29.8 | 0.20 | 2.0 |
| Morey | 57 | 2 | 29.2 | 0.26 | 4.0 |
| Palisade | 59 | −10 | 24.6 | 0.65 | |
| Palmetto | 64 | −6 | 28.0 | 0.50 | 5.0 |
| Potts | 53 | −11 | 21.4 | 0.08 | 2.0 |
| Reno State University | 60 | 2 | 31.8 | 0.21 | 1.7 |
| Sodaville | 58 | 5 | 32.4 | 0.00 | |
| Toano *[5] | 47 | −11 | 18.1 | 0.40 | 4.0 |
| Wabuska | 60 | −10 | 26.8 | | |
| Wadsworth *[1] | 65 | 4 | 32.2 | 0.05 | 0.5 |
| Wells | 48 | −12 | 21.7 | 1.30 | 13.0 |
| Wood | 47 | −6 | 22.2 | 1.64 | |
| *New Hampshire.* | | | | | |
| Alstead | 38 | −21 | 10.8 | 3.64 | 30.8 |
| Bartlett | | | | 3.72 | 41.5 |
| Berlin Mills | 41 | −41 | 8.1 | 2.90 | 28.0 |
| Bethlehem | 37 | −21 | 10.0 | 1.98 | 18.0 |
| Bretton Wood | | | | 1.94 | |
| Brookline *[1] | 40 | −36 | 15.9 | 3.85 | 33.5 |
| Chatham | 37 | −26 | 8.5 | 4.45 | 34.0 |
| Concord | 37 | −29 | 12.9 | 3.77 | 33.3 |
| Durham | 41 | −17 | 15.8 | 5.59 | 32.8 |
| Franklin Falls | 37 | −23 | 13.0 | 3.44 | 34.8 |
| Grafton | 35 | −31 | 10.2 | 2.49 | 27.5 |
| Hanover | 37 | −34 | 8.7 | 2.85 | 29.4 |
| Keene | 39 | −32 | 11.7 | 2.91 | 27.0 |
| Littleton | 36 | −22 | 9.8 | 4.12 | 15.0 |
| Nashua | 39 | −22 | 15.0 | 4.14 | 32.2 |
| Newton | 42 | −18 | 13.2 | 4.13 | 32.0 |
| North Stratford | | | | 1.80 | 20.7 |
| North Woodstock | | | | 3.84 | |
| Plymouth | 36 | −27 | 12.0 | 2.05 | 28.2 |
| Stratford | 37 | −35 | 8.6 | 1.16 | 12.0 |
| West Stewartstown | | | | 2.42 | 23.7 |
| *New Jersey.* | | | | | |
| Asbury Park | 53 | −7 | 26.0 | 3.77 | 15.7 |
| Barnegat | 52 | −7 | 26.4 | 1.79 | 6.5 |
| Bayonne | 53 | −14 | 22.7 | 3.52 | 17.2 |
| Belvidere | 53 | −15 | 20.3 | 4.32 | 23.0 |
| Bergen Point | 52 | −12 | 22.2 | 3.99 | 23.2 |
| Beverly | 57 | −9 | 24.7 | 3.71 | 12.8 |
| Blairstown | 48 | −19 | 18.3 | 3.95 | 23.5 |
| Bridgeton | 55 | −7 | 27.0 | 2.16 | 5.0 |
| Canton | | | | 2.24 | 9.8 |
| Cape May C. H. | 51 | −3 | 27.6 | 1.59 | 6.9 |
| Charlotteburg | 51[f] | −20[f] | 19.4[f] | 4.24 | 26.0 |
| Chester | 50 | −12 | 19.6 | 3.95 | 19.0 |
| Clayton | 55 | −12 | 24.8 | 2.17 | 11.0 |
| College Farm | 57 | −15 | 22.1 | 3.11 | 14.0 |
| Dover | 49 | −12 | 18.7 | 4.67 | 24.0 |
| Elizabeth | 52 | −16 | 22.6 | 4.04 | |
| Flemington | 52 | −14 | 21.6 | 3.50 | 15.6 |
| Friesburg | 54 | −7 | 25.6 | 2.29 | 9.0 |
| Imlaystown | 55 | −9 | 25.2 | 3.38 | 12.6 |
| Indian Mills | 58 | −14 | 25.2 | 2.43 | 12.0 |
| Lakewood | 55 | −12 | 25.3 | 2.25 | 13.5 |
| Lambertville | 54 | −13 | 22.8 | 4.03 | 17.5 |
| Moorestown | 56 | −9 | 24.0 | 3.02 | 12.8 |
| Newark | 52 | −10 | 21.8 | 3.27 | 15.9 |
| New Brunswick | 55 | −15 | 22.8 | 3.98 | 15.5 |
| Newton | 50 | −18 | 17.0 | 3.46 | 23.0 |
| Oceanic | 55 | −10 | 25.2 | 2.87 | 10.6 |
| Paterson | 53 | −6 | 24.0 | 3.91 | 27.2 |
| Pemberton | 55 | −12 | 24.0 | 3.04 | 11.5 |
| Phillipsburg | 53 | −10 | 20.6 | 3.36 | 21.4 |
| Plainfield | 52 | −13 | 21.8 | 3.99 | 20.3 |
| Pleasantville | | | | 1.54 | 7.0 |
| Rancocas | | | | 2.81 | 11.8 |
| Rivervale | 59 | −34 | 21.1 | 4.42 | 31.3 |
| Salem | 55 | −7 | 26.2 | 3.34 | 14.0 |
| Sandy Hook | 53 | −1 | 24.4 | 2.77 | 14.7 |
| Somerville | 53 | −15 | 22.0 | 3.78 | 17.5 |
| South Orange | 50 | −13 | 21.4 | 2.97 | 20.0 |
| Sussex | 49 | −22 | 18.0 | 3.88 | 34.4 |
| Toms River | 54 | −17 | 24.9 | 2.40 | 14.5 |
| Trenton | 56 | −3 | 28.4 | 2.73 | 8.0 |
| Tuckerton | 51 | −13 | 25.7 | 1.34 | 9.5 |
| Vineland | 58 | −11 | 25.8 | 2.43 | 7.2 |
| Woodbine | 56 | −9 | 25.8 | 1.96 | 8.5 |
| Woodstown | | | | 2.01 | 9.0 |
| *New Mexico.* | | | | | |
| Albert | 65 | 8 | 36.4 | T. | T. |
| Albuquerque | 62 | 15 | 36.4 | 0.20 | 2.0 |
| Arabela | 66 | 9 | 39.0 | 0.14 | 1.5 |
| Bellranch | | | | T. | T. |
| Cambray | | | | 0.04 | 0.2 |
| Carlsbad | 77 | 7 | 44.7 | 0.16 | T. |
| Cloudcroft | 52 | −2 | 24.8 | 0.85 | 8.5 |
| Deming | | | | 0.00 | |
| Dorsey | 59 | −2 | 29.0 | 0.04 | 1.0 |
| Eagle Rock Ranch | 57 | −4 | 26.2 | 0.50 | 6.0 |
| Fort Bayard | 63 | 8 | 35.4 | 0.16 | 1.5 |
| Fort Stanton | 65 | 0 | 32.1 | 0.02 | T. |
| Fort Union | 69 | −2 | 31.3 | T. | T. |
| Fort Wingate | 61 | 0 | 30.0 | 0.17 | 1.7 |

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

| Stations. | Temperature. (Fahrenheit.) Maximum. | Minimum. | Mean. | Precipitation. Rain and melted snow. | Total depth of snow. |
|---|---|---|---|---|---|
| *New Mexico*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Fruitland | 71 | − 9 | 27.8 | 0.12 | 1.2 |
| Gage | | | | T. | T. |
| Gallinas Spring | 65[b] | 8[b] | 34.0[b] | 0.35 | 3.5 |
| Golden | | | | 0.02 | 0.2 |
| Las Vegas | 63 | − 5 | 29.6 | 0.20 | 2.0 |
| Lordsburg | | | | 0.14 | |
| Los Lunas | 60 | 11 | 32.3 | 0.10 | 0.8 |
| Luna | 58 | −15 | 21.8 | 0.40 | 4.0 |
| Mesilla Park | 71 | 4 | 37.9 | T. | |
| Mountainair | 61 | − 3 | 29.4 | 0.10 | 1.0 |
| Raton | 56 | 8 | 32.6 | 0.30 | 3.0 |
| San Marcial | 70 | 5 | 35.9 | 0.20 | 2.0 |
| Strauss | | | | 0.00 | |
| Taos | 57 | − 4 | 23.0 | 0.40 | 5.0 |
| Winsors | 60 | − 6 | 22.5 | 0.50 | 5.0 |
| *New York.* | | | | | |
| Adams | | | | 6.52 | 73.0 |
| Addison | 48 | −35 | 17.7 | 2.47 | 22.5 |
| Akron | | | | 5.25 | 42.5 |
| Alden | 53 | −16 | 18.1 | 4.14 | 36.7 |
| Amsterdam | 41 | −26 | 11.4 | 3.74 | 33.9 |
| Angelica | 48 | −38 | 15.6 | 2.69 | 27.0 |
| Appleton | 49 | −13 | 19.2 | 2.42 | |
| Arcade | 48 | −38 | 13.4 | 4.31 | 40.4 |
| Athens | 48 | −21 | 16.0 | 3.38 | 28.8 |
| Atlanta | 49 | −35 | 16.4 | 4.56 | 35.5 |
| Auburn | 50 | −17 | 18.2 | 4.05 | 36.0 |
| Avon | 45 | −25 | 17.8 | 2.65 | 17.5 |
| Baldwinsville | 43 | −28 | 16.6 | 4.77 | 35.5 |
| Beaver | | | | 3.95 | 39.5 |
| Bedford | 49 | −17 | 20.2 | 2.19 | 5.3 |
| Berlin | 47 | −35 | 15.9 | 2.40 | 19.0 |
| Blue Mountain Lake | | | | 3.65 | 23.0 |
| Bolivar | 52 | −37 | 15.4 | 3.81 | 26.5 |
| Bouckville | 44 | −24 | 13.4 | 5.39 | 44.0 |
| Boyds Corners | | | | 4.52 | |
| Brockport | 47 | −14 | 18.4 | 3.47 | 27.0 |
| Caldwell | 43 | −32 | 11.4 | 4.17 | 16.9 |
| Canajoharie | 37 | −28 | 11.2 | 2.85 | 34.3 |
| Canaan Four Corners | 49 | −23 | 14.2 | 2.70 | 19.0 |
| Carmel | 38 | −20 | 14.4 | 3.82 | 23.0 |
| Carvers Falls | 40 | −37 | 7.0 | 1.85 | 18.0 |
| Chazy | 43 | −28 | 10.0 | 1.55 | 15.5 |
| Cooperstown | 47 | −33 | 12.9 | 4.29 | 32.3 |
| Cortland | 47 | −29 | 14.2 | 3.62 | 32.7 |
| Cutchogue | 49 | − 5 | 24.6 | 5.85 | 25.0 |
| Deansboro | | | | 4.93 | 33.3 |
| Dekalb Junction | 51 | −33 | 9.7 | 2.25 | 20.1 |
| De Ruyter | 47 | −36 | 13.6 | 3.54 | 27.2 |
| Easton | | | | 2.45 | 22.0 |
| Elba | 44 | −15 | 17.2 | 4.45 | 34.5 |
| Elmira | 54 | −24 | 17.6 | 3.18 | 17.3 |
| Fayetteville | 52 | −29 | 16.2 | 2.92 | 22.3 |
| Franklinville | 50 | −34 | 13.3 | 4.48 | 44.3 |
| Gabriels | 44 | −46 | 7.6 | 3.50 | 29.0 |
| Gansevoort | | | | 4.20 | 33.5 |
| Glens Falls | 41 | −36 | 11.2 | 3.55 | 28.3 |
| Gloversville | 40 | −32 | 10.8 | 4.33 | 37.5 |
| Greenwich | 46[e] | −28[e] | 12.2[e] | 1.76 | 16.5 |
| Griffin Corners | 52 | −31 | 14.0 | 3.71 | 33.0 |
| Harkness | 45 | −24 | 11.6 | 1.48 | 13.0 |
| Haskinville | | | | 2.79 | 21.7 |
| Hemlock | 46 | −20 | 17.4 | 2.90 | 20.0 |
| Honeymead Brook | 47 | −21 | 15.8 | 4.18 | 23.9 |
| Hunt | 49 | −25 | 15.4 | | |
| Indian Lake | 44 | −40 | 8.4 | 3.41 | 39.2 |
| Ithaca | 50 | −20 | 16.8 | 3.46 | 32.9 |
| Jamestown | 52 | −31 | 16.8 | 5.03 | 23.5 |
| Jeffersonville | 43 | −30 | 14.0 | 3.65 | 30.3 |
| Keene Valley | 47 | −36 | 11.1 | 2.24 | 19.7 |
| King Ferry | | | | 4.23 | 43.6 |
| Le Roy | | | | 2.99 | 18.1 |
| Liberty | 48 | −14 | 14.8 | 2.82 | 29.8 |
| Littlefalls, City Res. | 42 | −23 | 11.9 | 2.33 | 35.5 |
| Lockport | 48 | −12 | 18.2 | 3.66 | |
| Lowville | 44 | −32 | 10.2 | 3.01 | 22.3 |
| Lyndonville | | | | 2.66 | 23.6 |
| Lyons | 48 | −12 | 18.8 | 3.71 | 26.0 |
| Middletown | 45 | −16 | 17.6 | 2.81 | 16.5 |
| Mohonk Lake | 48 | −16 | 16.5 | 2.90 | 25.5 |
| Moira | 51 | −30 | 9.3 | 3.10 | 22.0 |
| Newark Valley | | | | 3.61 | 28.0 |
| New Lisbon | 48 | −37 | 11.6 | 3.73 | 35.2 |
| North Hammond | 46 | −36 | 8.9 | 1.66 | 49.0 |
| Number Four | 45 | −30 | 10.4 | | |
| Ogdensburg | 38 | −43 | 9.6 | 1.52 | 17.7 |
| Old Chatham | | | | 2.38 | |
| Oneonta | 50 | −28 | 15.4 | 3.57 | 28.0 |
| Oswegatchie | 51 | −31 | 12.6 | 3.76 | 42.5 |
| Otto | | −24 | 15.2 | 3.62 | |
| Oxford | 45 | −31 | 14.8 | 4.63 | 36.8 |
| Oyster Bay | 49 | − 1 | 25.4 | 3.12 | 12.0 |
| Palermo | | | | 5.55 | 56.5 |
| Penn Yan | 48 | −15 | 18.4 | 2.43 | 16.0 |
| Perry City | 46 | −26 | 16.3 | 2.70 | 25.8 |
| Plattsburg Barracks | | | | 2.74 | 27.0 |
| Port Jervis | 47 | −20 | 17.7 | 3.42 | 21.5 |
| Potsdam | 45 | −40 | 9.6 | 2.42 | 25.0 |
| *New York*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Primrose | 48 | −20 | 20.4 | 3.19 | 25.0 |
| Redhook | | | | 3.76 | |
| Richmondville | 52 | −23 | 14.5 | 3.21 | 25.5 |
| Ridgeway | 49 | − 9 | 19.1 | 3.34 | 26.6 |
| Rome | 41 | −27 | 14.2 | 5.27 | 51.0 |
| Romulus | 48 | −12 | 19.1 | 3.28 | 24.9 |
| Salisbury Mills | | | | 4.49 | 18.0 |
| Saranac Lake | 48 | −39[c] | 10.8 | 2.18 | 19.5 |
| Saratoga Springs | 43 | −29 | 12.6 | 3.90 | 32.5 |
| Setauket | 51 | 1 | 24.4 | 3.84 | 16.0 |
| Shortsville | 51 | − 9 | 18.7 | 4.21 | 19.1 |
| Skaneateles | | | | 4.07 | 38.9 |
| Southampton | 51 | − 8 | 24.4 | 4.23 | 19.6 |
| South Butler | | | | 3.43 | |
| South Canisteo | 48 | −26 | 16.2 | 3.45 | 25.0 |
| Southeast Reservoir | | | | 3.73 | |
| South Kortright | 52 | −36 | 13.6 | 2.37 | 26.5 |
| South Schroon | 42 | −43 | 10.2 | 3.25 | 38.6 |
| Spier Falls | 46 | −32 | 12.3 | 4.36 | 31.5 |
| Straits Corners | 50 | −24 | 14.4 | 3.94 | 26.9 |
| Ticonderoga | 45 | −25 | 11.9 | 2.55 | 40.0 |
| Volusia | 51 | −13 | 17.5 | 5.71 | 31.0 |
| Wappinger Falls | 47 | −34 | 14.9 | 5.54 | 33.0 |
| Warwick | | | | 3.94 | 30.0 |
| Watertown | 49 | −30 | 12.1 | 2.41 | 34.0 |
| Waverly | 51 | −31 | 16.5 | 3.47 | 26.9 |
| Wedgwood | 45 | −13 | 16.0 | 3.68 | 31.3 |
| Wells | 39 | −42 | 9.2 | 4.54 | 44.4 |
| West Berne | 49 | −33 | 11.1 | 2.20 | 22.0 |
| Westfield *b* | 54 | −12 | 18.2 | 4.51 | |
| Windham | 53 | −34 | 15.0 | 3.15 | 31.6 |
| Youngstown | | | | 2.95 | 22.1 |
| *North Carolina.* | | | | | |
| Brevard | 60 | − 3 | 32.4 | 3.01 | 9.0 |
| Bryson City | | | | 3.72 | 4.6 |
| Chapelhill | 68 | 11 | 34.9 | 2.67 | 4.5 |
| Currituck | | | | 3.36 | |
| Edenton | 63 | 13 | 36.8 | 3.67 | T. |
| Fayetteville | 73 | 9 | 39.0 | 2.80 | T. |
| Goldsboro | 69 | 4 | 36.5 | 2.60 | 5.5 |
| Graham | | | | 2.70 | 12.6 |
| Greensboro | 63 | 12 | 33.4 | 3.35 | 4.5 |
| Henderson | 67 | 12 | 35.8 | 2.71 | 3.5 |
| Hendersonville | 60 | − 8 | 33.2 | 2.48 | 6.5 |
| Henrietta | 70 | 9 | 37.0 | 2.08 | 4.5 |
| Highlands | 55 | − 8 | 29.0 | 6.07 | 12.5 |
| Horse Cove | 58 | 11 | 33.8 | 4.33 | 9.3 |
| Hot Springs | 65 | 12 | 36.2 | | 9.0 |
| Jefferson | 59 | − 4 | 30.2 | 2.04 | 12.1 |
| Kinston | 67 | 10 | 35.6 | 4.12 | 8.2 |
| Kittyhawk | 65 | 18 | 39.8 | 4.23 | 1.0 |
| Lenoir | 63 | 5 | 32.8 | 1.61 | 6.0 |
| Linville | 51 | − 4 | 28.4 | 3.30 | 13.0 |
| Littleton | 69 | 10 | 33.2 | 2.41 | 7.0 |
| Louisburg | 70 | 9 | 36.5 | 2.51 | 5.0 |
| Lumberton | 71 | 6 | 36.7 | 2.37 | 3.5 |
| Marion | 63 | 6 | 35.1 | 2.48 | 7.0 |
| Marshall | 67 | 2 | 35.3 | 1.69 | 13.7 |
| Moncure | 70 | 8 | 36.6 | 3.08 | 3.5 |
| Monroe | 67 | 7 | 37.8 | 2.59 | 0.2 |
| Morganton | 63 | 4 | 34.9 | 1.50 | 6.5 |
| Mountairy | 61 | 1 | 31.4 | 1.55 | 11.0 |
| Murphy | | | | 3.85 | 6.0 |
| Newbern | 68 | 15 | 39.6 | 4.24 | 8.0 |
| Patterson *[1] | 56 | 6 | 30.2 | 2.29 | 6.1 |
| Pinehurst | 69 | 13 | 38.5 | 3.70 | |
| Reidsville | 65 | 10 | 34.6 | 2.39 | 7.6 |
| Rockingham | 72 | 12 | 38.4 | 2.86 | 1.0 |
| Salem | 61 | 4 | 33.4 | | 6.0 |
| Salisbury | 65 | 13 | 39.2 | 1.86 | 3.5 |
| Saxon | 63 | 2 | 31.8 | 1.86 | 7.5 |
| Selma | 68[b] | 16[f] | 38.1[d] | 3.85 | 6.0 |
| Settle | 62 | 7 | 34.6 | 1.55 | 6.0 |
| Sloan | 72 | 5 | 40.0 | 2.66 | 4.0 |
| Soapstone Mount | 65 | 2 | 35.8 | 2.58 | 4.0 |
| Southern Pines *a* | 70 | 10 | 39.0 | 3.78 | 3.0 |
| Southern Pines *b* | 70 | 12 | 37.4 | 3.82 | 2.5 |
| Southport | 61 | 14 | 41.4 | 3.97 | 4.5 |
| Springhope | 70 | 12 | 38.0 | 4.00 | 3.0 |
| Statesville | 63 | 6 | 35.2 | 2.07 | 5.0 |
| Tarboro | 69 | 10 | 37.2 | 3.21 | 0.8 |
| Washington | 70 | 9 | 39.0 | 3.57 | 6.0 |
| Waynesville | 61 | 4 | 33.3 | 2.55 | 4.5 |
| Weldon *a* | 71 | 9 | 34.4 | 3.13 | 3.5 |
| Weldon *b* | | | | 3.18 | 3.8 |
| Whiteville | 70 | 12 | 41.2 | 2.91 | 3.5 |
| *North Dakota.* | | | | | |
| Amenia | 37[c] | −36[d] | 4.5[d] | 0.34 | 3.4 |
| Ashley | 32 | −40 | 1.4 | 0.25 | 2.5 |
| Berlin | 37 | −42 | 3.0 | 0.35 | 3.5 |
| Bottineau | 35 | −40 | 2.2 | 0.36 | 3.6 |
| Buxton | 35 | −38 | 3.3 | 0.56 | 5.6 |
| Churchs Ferry | 32 | −41 | −1.6 | 0.40 | 4.0 |
| Cooperstown | 46 | −40 | 6.0 | | |
| Devils Lake | 31 | −41 | 0.0 | 1.69 | 16.9 |
| Dickinson | 40 | −28 | 9.6 | 0.33 | 3.1 |
| Donnybrook | 36 | −37 | 4.0 | 0.35 | 3.5 |
| Dunseith | 39 | −42 | 0.2 | 0.40 | 4.0 |
| *North Dakota*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Edgeley | 36 | −38 | 5.0 | 0.23 | 4.5 |
| Elbowoods | 40 | −38 | 3.0 | 0.23 | 2.3 |
| Ellendale | 36 | −37 | 5.0 | 0.35 | 3.5 |
| Fargo | 36 | −39 | 1.2 | 0.13 | 1.3 |
| Forman | 45 | −39 | 4.3 | 0.21 | 2.1 |
| Fort Yates | 42 | −31 | 9.0 | 0.32 | 4.1 |
| Fullerton | 37 | −40 | 4.6 | 0.43 | 4.3 |
| Glenullin | 38 | −32 | 9.2 | 1.10 | 9.3 |
| Grafton | 35 | −36 | −0.2 | 0.60 | 6.0 |
| Hamilton | 35 | −40 | −1.2 | 0.60 | 6.1 |
| Hannaford | 39 | −41 | 1.8 | 0.21 | 2.1 |
| Jamestown | 33 | −38 | 3.2 | 0.78 | 7.8 |
| Larimore | 33 | −38 | 1.9 | 0.45 | 4.5 |
| Lisbon | 38 | −40 | 3.2 | 0.15 | 1.5 |
| Manfred | 34 | −41 | 3.3 | 0.56 | 5.6 |
| Mayville | | −37[i] | | 0.35 | 3.5 |
| Medora | 45 | −25 | 7.5 | 0.80 | 8.0 |
| Melville | 35 | −38 | 3.8 | 0.05 | 0.5 |
| Milton | 32 | −52 | −4.4 | | |
| Minnewaukon | 33 | −38 | 3.6 | 0.31 | 3.1 |
| Minot | 38 | −38 | 5.5 | 0.20 | 2.0 |
| Minto | 35 | −36 | 1.2 | 0.19 | 1.9 |
| Napoleon | 32 | −41 | 2.1 | 0.20 | 2.0 |
| New England | 40[e] | −26[e] | 10.0[e] | 0.45 | 4.5 |
| Oakdale | 50 | −36 | 11.2 | 0.19 | 1.9 |
| Park River | 35 | −41 | −0.4 | 0.33 | 4.0 |
| Pembina | 36 | −42 | −4.2 | 0.29 | 2.9 |
| Portal | 37 | −37 | 3.7 | 0.40 | 4.0 |
| Power | 37 | −38 | 3.3 | 0.32 | 3.2 |
| Steele | 33 | −40 | 3.2 | T. | T. |
| University | 37 | −37 | 7.0 | 0.30 | 3.0 |
| Willow City | 35 | −43 | −0.3 | T. | T. |
| Wishek | 32 | −41 | 1.2 | 0.47 | 4.7 |
| *Ohio.* | | | | | |
| Akron | 59 | −10 | 20.4 | 4.40 | 22.0 |
| Atwater | | | | 4.85 | 13.5 |
| Bangorville | 58 | −12 | 20.4 | 5.65 | 16.0 |
| Bellefontaine | 49 | −16 | 19.1 | 3.83 | 12.1 |
| Benton Ridge | 43 | −20 | 18.8 | 7.23 | 30.3 |
| Bladensburg | 61 | −24 | 19.0 | 3.39 | 13.5 |
| Bowling Green | 44 | −17 | 16.3 | 5.23 | 14.5 |
| Bucyrus | 50 | −15 | 19.2 | 3.95 | 21.0 |
| Cadiz | 60 | − 7 | 22.0 | 3.44 | 14.0 |
| Cambridge | 70 | −27 | 20.9 | 2.86 | 14.0 |
| Camp Dennison | 60 | −10 | 25.0 | 2.45 | 5.5 |
| Canal Dover | 60 | −24 | 19.2 | 4.75 | 12.5 |
| Canton | 58 | −13 | 20.1 | 4.11 | 18.9 |
| Cardington | 55 | −21 | 18.0 | 4.94 | 15.9 |
| Clarington | 65 | −10 | 26.0 | 3.01 | 16.1 |
| Clarksville | 61 | −11 | 24.0 | 2.93 | 10.5 |
| Cleveland *a* | 50 | − 4 | 20.8 | 4.50 | 18.4 |
| Cleveland *b* | 50 | − 6 | 19.4 | 3.26 | 15.0 |
| Clifton | 58 | −20 | 21.9 | 3.40 | 14.0 |
| Coalton | 66 | − 7 | 26.6 | 2.05 | |
| Crooksville | 62 | −25 | 2.22 | 1.76 | 12.1 |
| Dayton *a* | | | | 3.50 | 15.3 |
| Dayton *b* | 54 | −18 | 21.3 | 4.61 | 15.9 |
| Defiance | 39 | −16 | 16.8 | 5.37 | 15.9 |
| Delaware | 59 | −21 | 19.1 | 3.79 | 13.7 |
| Demos | 62 | − 6 | 23.2 | 1.90 | 7.0 |
| Elyria | 49 | −14 | 19.4 | 3.94 | |
| Findlay | 45 | −15 | 18.5 | 6.11 | 20.0 |
| Frankfort | 65 | −19 | 22.9 | 1.99 | 9.0 |
| Fremont | 44 | −12 | 19.4 | 5.26 | 23.2 |
| Garrettsville | 60 | −25 | 17.8 | 4.92 | 17.0 |
| Granville | 63 | −20 | 20.4 | 3.85 | 17.0 |
| Gratiot | 60 | −24 | 20.6 | 2.65 | 13.3 |
| Green | 67 | 3 | 30.2 | 2.64 | 2.0 |
| Greenfield | 61 | − 7 | 24.4 | 1.99 | 8.0 |
| Greenhill | 61 | −22 | 18.0 | 3.65 | 11.0 |
| Greenville | 47 | −15 | 19.3 | 4.54 | 15.0 |
| Hanging Rock | 69 | − 1 | 30.0 | 1.90 | |
| Hedges | 41 | −20 | 17.7 | 5.09 | 5.4 |
| Hillhouse | 51 | −16 | 17.2 | 3.66 | 13.0 |
| Hiram | 58 | − 6 | 19.0 | 4.91 | 17.5 |
| Hudson | 55 | −14 | 17.6 | 3.80 | 22.0 |
| Jacksonboro | 54 | −10 | 23.6 | 4.53 | |
| Kenton | 47 | −15 | 18.6 | 4.09 | 13.4 |
| Killbuck | 60 | −15 | 19.9 | 4.41 | 14.4 |
| Lancaster | 65 | −21 | 23.0 | 2.45 | 12.0 |
| Lima | 44 | −17 | 18.8 | 6.52 | 21.0 |
| McConnelsville | 65 | −18 | 22.9 | 2.44 | 8.0 |
| Manara | 60 | −20 | 21.0 | 2.09 | 9.5 |
| Mansfield | | | | 5.35 | 18.0 |
| Marietta | 63 | −10 | 26.8 | 1.86 | 6.4 |
| Marion | 50 | −15 | 19.6 | 4.43 | 16.9 |
| Medina | 56 | −18 | 18.4 | 4.88 | 13.0 |
| Milfordton | 59 | −15 | 19.4 | 4.37 | 16.0 |
| Milligan | 63 | −30 | 20.3 | 2.29 | 10.0 |
| Millport | 60 | −26 | 18.0 | 3.63 | 20.0 |
| Montpelier | 39 | −18 | 15.4 | 4.16 | 28.0 |
| Napoleon | 40 | −13 | 17.6 | 5.21 | 13.0 |
| New Alexandria | 62 | −11 | 22.3 | 3.59 | 9.0 |
| New Berlin | 58 | −15 | 19.6 | 4.69 | 13.5 |
| New Bremen | 45 | −25 | 18.6 | 5.00 | 19.0 |
| New Richmond | 54 | − 4 | 27.0 | 2.29 | 2.7 |
| New Waterford | 58 | −24 | 19.2 | 4.40 | 18.0 |
| North Lewisburg | 51 | −14 | 19.1 | 4.20 | 16.5 |

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

| Stations. | Temperature. (Fahrenheit.) Maximum. | Minimum. | Mean. | Precipitation. Rain and melted snow. | Total depth of snow. |
|---|---|---|---|---|---|
| *Ohio*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| North Royalton | 54 | — 6 | 18.4 | 5.68 | 20.0 |
| Oberlin | 51 | —14 | 19.2 | 4.65 | ...... |
| Ohio State University | 60 | —18 | 19.6 | 2.98 | 13.0 |
| Orangeville | 60 | —28 | 17.9 | 4.34 | 18.0 |
| Ottawa | 45 | —20 | 17.8 | 4.49 | 17.0 |
| Pataskala | 62 | —17 | 20.8 | 2.97 | 14.6 |
| Philo | 63 | — 8 | 23.4 | 1.76 | 11.6 |
| Plattsburg | 64 | —11 | 21.2 | 3.70 | 14.0 |
| Pomeroy | 64 | 1 | 27.5 | 1.50 | 3.0 |
| Portsmouth *a* | ...... | ...... | ...... | 2.16 | 1.0 |
| Portsmouth *b* | 68 | 2 | 29.9 | 2.19 | 1.0 |
| Pulse | 60 | —18 | 23.7 | 2.21 | 10.5 |
| Richwood | 51 | —21 | 18.1 | 3.69 | 9.4 |
| Rittman | ...... | ...... | ...... | 5.42 | 14.5 |
| Rockyridge | 40 | —14 | 18.0 | 4.48 | 16.0 |
| Shenandoah | 55 | —12 | 17.7 | 5.05 | 14.4 |
| Sidney | 56 | —20 | 20.9 | 4.96 | 19.2 |
| Somerset | 63 | — 7 | 23.4 | 2.64 | 17.1 |
| Springfield | ...... | ...... | ...... | 3.62 | 15.2 |
| Thurman | 68 | — 2 | 28.3 | 1.96 | 6.0 |
| Tiffin | 49 | —11 | 19.4 | 6.76 | 26.2 |
| Upper Sandusky | 47 | —13 | 18.2 | 5.27 | 18.2 |
| Urbana | 49 | —19 | 18.2 | 3.40 | 16.0 |
| Vickery | 41 | —17 | 17.6 | 4.90 | 13.7 |
| Warren | 60 | —22 | 19.0 | 5.55 | 28.8 |
| Wauseon | 39 | —14 | 15.4 | 4.53 | 21.0 |
| Waverly | 66 | — 8 | 26.2 | 2.06 | 8.3 |
| Waynesville | 56 | —12 | 21.9 | 3.40 | 12.0 |
| Wellington | 51 | —16 | 19.2 | 4.82 | 14.5 |
| Wilson | 65 | — 9 | 25.4 | 2.05 | 3.0 |
| Wooster | 60 | —21 | 18.6 | 5.27 | 15.0 |
| Zanesville | ...... | ...... | ...... | 2.13 | 12.8 |
| *Oklahoma.* | | | | | |
| Arapaho | 73 | — 5 | 34.1 | 0.06 | T. |
| Beaver | 66 | 1 | 31.5 | T. | T. |
| Binger | 69 | 0 | 34.5 | 0.43 | 0.2 |
| Blackburn | 67 | 0 | 33.8 | 0.84 | T. |
| Chandler | 68 | 1 | 36.1 | 1.80 | T. |
| Cleo | 68 | 2 | 34.3 | 0.12 | |
| Cloud Chief | 71 | — 4 | 35.3 | 0.30 | T. |
| Eldorado | 79 | — 2 | 37.2 | 0.02 | 0.2 |
| Enid | 71 | — 2 | 34.6 | 0.25 | T. |
| Fort Reno | 70 | — 1 | 36.6 | 0.90 | 5.5 |
| Fort Sill | 68 | 5 | 37.0 | 1.50 | 2.0 |
| Guthrie | 68 | 1 | 36.3 | 0.70 | T |
| Harrington | 70 | — 2 | 36.0 | T. | T. |
| Hennessey | 72 | 2 | 37.0 | 0.60 | T. |
| Hobart | 73 | 3 | 35.6 | 0.66 | T. |
| Jefferson | 73 | 0 | 34.0 | 0.27 | T. |
| Jenkins | 73 | — 1 | 34.6 | 0.33 | T. |
| Kenton | 65 | 3 | 33.4 | 0.20 | 2.0 |
| Kingfisher | 74 | 0 | 36.0 | 0.60 | T. |
| McComb | 70 | 4 | 38.1 | 1.24 | 1.0 |
| Mangum | 75 | 10 | 37.1 | 0.50 | T. |
| Meeker | 69 | 1 | 37.4 | 1.50 | |
| Newkirk | 66 | — 6 | 31.8 | 0.74 | |
| Norman | 77 | 3 | 37.2 | 1.22 | 1.4 |
| Pawhuska | ...... | ...... | ...... | 0.70 | T. |
| Perry | 68 | 0 | 35.3 | 1.33 | T. |
| Sac and Fox Agency | 68 | 6 | 39.2 | 1.50 | |
| Shawnee | 69 | 3 | 36.6 | 1.65 | T. |
| Taloga | 63 | — 2 | 32.6 | 0.20 | |
| Temple | 71 | 2 | 37.6 | 2.01 | 6.0 |
| Watonga | 79 | — 4 | 38.0 | 0.20 | |
| Waukomis | 72 | 0 | 37.7 | 0.45 | T. |
| Weatherford | 71 | — 1 | 34.4 | 0.18 | T. |
| Woodward | ...... | ...... | ...... | T. | T. |
| *Oregon.* | | | | | |
| Albany | ...... | ...... | ...... | 4.66 | 0.8 |
| Alpha | 57 | 26 | 41.6 | 13.79 | 4.2 |
| Arlington | 57 | 25 | 38.2 | 0.95 | T. |
| Ashland | 57 | 17 | 36.7 | 2.16 | 3.2 |
| Astoria | 56 | 30 | 41.1 | 13.30 | |
| Aurora (near) | 58 | 27 | 40.0 | 4.89 | 1.0 |
| Bay City | 54 | 28 | 42.2 | 21.04 | 4.0 |
| Bend | 59 | 9 | 34.4 | 1.52 | 1.1 |
| Beulah | 55 | — 6 | 28.5 | 0.83 | 8.5 |
| Blackbutte | 50 | 26 | 37.2 | 4.60 | 8.0 |
| Blalock | 59 | 26 | 39.2 | 0.86 | T. |
| Bullrun | ...... | ...... | ...... | 12.37 | 5.0 |
| Burns | 48 | 0 | 26.4 | 0.77 | 8.0 |
| Burns (near) | ...... | ...... | ...... | 1.02 | 9.0 |
| Butter Creek | ...... | ...... | ...... | 0.80 | 3.4 |
| Cascade Locks | 55 | 29 | 40.6 | 12.12 | 1.0 |
| Coquille | ...... | ...... | ...... | 7.96 | |
| Corvallis | 56 | 28 | 40.5 | 5.56 | 1.0 |
| Dayville | 57 | 16 | 36.8 | 0.62 | 4.9 |
| Doraville | 51 | 25 | 37.8 | 7.95 | 14.2 |
| Drain | 63 | 29 | 42.0 | 6.38 | 2.0 |
| Ella | ...... | ...... | ...... | 0.70 | 1.5 |
| Eugene | 59 | 30 | 41.3 | 5.30 | 1.6 |
| Fairview | 65 | 26 | 44.8 | 10.71 | 0.3 |
| Falls City | 53 | 25 | 28.0 | 11.63 | 4.0 |
| Forestgrove | 56 | 23 | 39.4 | 7.89 | 6.0 |
| Gardiner | 62 | 30 | 46.2 | 14.09 | |
| Glenora | 51 | 25 | 37.9 | 21.20 | 11.5 |
| Gold Beach | 73[e] | 32[e] | 48.4[e] | 3.14 | 0.2 |
| Government Camp | 56 | 11 | 31.6 | 13.03 | 71.0 |
| *Oregon*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Grants Pass | 60 | 21 | 40.4 | 2.72 | T. |
| Grass Valley | 56 | 17 | 36.0 | 0.15 | |
| Heppner | ...... | ...... | ...... | 0.38 | 1.6 |
| Hood River (near) | 57 | 23 | 38.4 | 3.91 | 6.5 |
| Huntington | 46 | 11 | 28.6 | 1.30 | 15.0 |
| Jacksonville | 58 | 23 | 40.2 | 5.75 | 1.8 |
| John Day | 69 | 4 | 35.0 | 1.30 | 11.3 |
| Joseph | 48 | — 3 | 25.8 | 1.45 | 14.5 |
| Kerby | 58 | 20 | 39.0 | 6.92 | 6.0 |
| Klamath Falls | 46 | 4 | 27.2 | 1.00 | 10.0 |
| Lagrande | 51 | 12 | 31.6 | 1.91 | 17.0 |
| Lakeview | 47 | — 4 | 24.9 | 1.41 | 6.5 |
| Langlois | 66 | 30 | 45.7 | 11.36 | |
| Lonerock | 61 | 13 | 37.6 | 1.31 | 3.2 |
| McKenzie Bridge | 52 | 20 | 36.0 | 12.04 | ...... |
| McMinnville | 58 | 27 | 41.5 | 5.95 | 3.0 |
| Meacham | ...... | ...... | ...... | 4.57 | 45.0 |
| Monroe | 58 | 25 | 40.9 | 6.27 | 4.0 |
| Mount Angel | 57 | 30 | 41.7 | 4.92 | 4.0 |
| Nehalem | ...... | ...... | ...... | 18.59 | 5.0 |
| Newport | 57 | 32 | 44.4 | 11.08 | 2.0 |
| Ontario | ...... | ...... | ...... | 0.85 | 8.5 |
| Pine | 50 | —11 | 20.2 | 2.33 | 22.0 |
| Prineville | 54 | 11 | 34.2 | 0.43 | 1.2 |
| Riverside | ...... | ...... | ...... | 0.16 | 0.5 |
| Salem | 57 | 30 | 41.9 | 3.78 | |
| Sparta | 44 | — 5 | 26.6 | 3.10 | 31.0 |
| Stafford | 57 | 28 | 39.6 | 6.22 | T. |
| The Dalles | 59 | 25 | 40.2 | 1.52 | T. |
| Toledo | 58 | 29 | 43.4 | 13.38 | 2.0 |
| Umatilla | 59 | 21 | 37.2 | 1.07 | 0.4 |
| Vale | 52 | — 1 | 26.9 | 0.90 | 9.0 |
| Wallowa | 51 | — 3 | 27.0 | 1.56 | 22.0 |
| Wamic | 56 | 10 | 36.2 | 2.31 | 5.5 |
| Warm Spring | 58 | 17 | 37.1 | 0.50 | T. |
| Weston | 58 | 7 | 35.2 | 2.34 | 10.0 |
| Williams | 64 | 20 | 39.5 | 3.71 | 4.5 |
| *Pennsylvania.* | | | | | |
| Aleppo | 65 | —17 | 23.4 | 2.27 | 14.0 |
| Altoona | 49 | —18 | 18.5 | 3.63 | ...... |
| Athens | 52 | —27 | 17.4 | 3.02 | 18.5 |
| Beaver Dam | ...... | ...... | ...... | 2.12 | 20.5 |
| Bellefonte | 49 | —19 | 19.6 | 3.72 | 25.0 |
| Brookville | ...... | ...... | ...... | 3.90 | 15.2 |
| Browers | ...... | ...... | ...... | 3.88 | ...... |
| California | 64 | —10 | 26.3 | 2.78 | 14.4 |
| Cassandra | 56 | —19 | 19.5 | 3.89 | 23.0 |
| Centerhall | 50 | —18 | 19.0 | 2.90 | 20.1 |
| Clarion | ...... | ...... | ...... | 3.98 | 17.6 |
| Coatesville | 56 | — 7 | 23.6 | 3.68 | 16.5 |
| Coudersport | 49 | —33 | 15.6 | ...... | ...... |
| Confluence | ...... | ...... | ...... | 2.87 | ...... |
| Davis Island Dam | ...... | ...... | ...... | 3.53 | ...... |
| Derry | 65 | —20 | 23.8 | 3.09 | 15.0 |
| Doylestown | ...... | ...... | ...... | 5.11 | ...... |
| Dushore | 50 | —30 | 16.0 | 3.34 | 20.5 |
| East Bloomsburg | ...... | ...... | ...... | 4.55 | 35.2 |
| East Mauch Chunk | 51 | —12 | 19.0 | 4.78 | 27.6 |
| Easton | 53 | — 9 | 21.2 | 3.06 | 17.4 |
| Ellwood Junction | ...... | ...... | ...... | 3.20 | 21.0 |
| Emporium | 48 | —29 | 17.6 | 3.04 | 17.7 |
| Ephrata | 55 | —15 | 21.6 | 2.95 | 13.5 |
| Everett | 50 | —21 | 19.1 | 3.08 | 20.5 |
| Forks of Neshaminy | ...... | ...... | ...... | 3.98 | ...... |
| Franklin | 58 | —30 | 19.4 | 5.42 | 32.0 |
| Freeport | 53 | —22 | 22.1 | 3.35 | 16.8 |
| Gettysburg | 51 | —12 | 22.6 | 3.57 | 27.5 |
| Girardville | ...... | ...... | ...... | 5.78 | 42.7 |
| Gordon | 53 | —26 | 18.0 | ...... | 24.0 |
| Grampian | 55 | —32 | 16.4 | 5.75 | 37.0 |
| Greensboro | ...... | ...... | ...... | 2.08 | 8.0 |
| Greenville | ...... | ...... | ...... | 5.03 | 26.8 |
| Hamburg | 49 | —11 | 20.8 | 3.66 | 19.5 |
| Hawthorn | 56[e] | —30[e] | 18.2[e] | ...... | ...... |
| Herrs Island Dam | ...... | ...... | ...... | 2.62 | ...... |
| Huntingdon *a* | ...... | ...... | ...... | 2.83 | 24.0 |
| Huntingdon *b* | 54 | —19 | 20.0 | 3.07 | 23.1 |
| Indiana | 58 | —12 | 21.8 | 3.18 | 19.7 |
| Irwin | 65 | —17 | 24.5 | 2.74 | 10.6 |
| Johnstown | 54 | —15 | 23.1 | 4.10 | 24.3 |
| Keating | ...... | ...... | ...... | 2.71 | 12.3 |
| Kennett Square | 56 | — 5 | 24.2 | 3.66 | 11.5 |
| Lansdale | ...... | ...... | ...... | 3.33 | ...... |
| Lawrenceville | 50 | —38 | 15.8 | 3.08 | 27.5 |
| Lebanon | 52 | —12 | 21.2 | 3.58 | 22.8 |
| Leroy | 50 | —20 | 16.3 | 2.83 | 17.0 |
| Lewisburg | 50 | —29 | 16.2 | 4.52 | 33.0 |
| Lockhaven *a* | 53 | —20 | 17.5 | 3.66 | 28.0 |
| Lockhaven *b* | ...... | ...... | ...... | 3.00 | 19.0 |
| Lock No. 4 | ...... | ...... | ...... | 2.64 | 13.8 |
| Lycippus | 65 | — 7 | 24.4 | 3.38 | 26.4 |
| Marion | 51 | —17 | 20.8 | 3.04 | 13.5 |
| Mifflin | ...... | ...... | ...... | 2.95 | 27.5 |
| Mifflintown | 50 | —20 | 18.8 | 2.62 | 25.5 |
| Milford | 51 | —24 | 16.6 | 3.81 | 30.5 |
| Montrose | 48 | —21 | 15.4 | 5.05 | 8.4 |
| New Germantown | 57 | —20 | 20.0 | 2.54 | 20.5 |
| Oil City | ...... | ...... | ...... | 5.45 | 31.1 |
| *Pennsylvania*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Ottsville | ...... | ...... | ...... | 3.51 | ...... |
| Parker | ...... | ...... | ...... | 3.84 | 18.4 |
| Philadelphia | 56 | — 2 | 26.5 | 3.56 | 12.0 |
| Pocono Lake | 49 | —27 | 14.9 | 3.44 | 29.0 |
| Point Pleasant | ...... | ...... | ...... | 4.19 | ...... |
| Pottsville | ...... | ...... | ...... | 3.86 | ...... |
| Quakertown | 53 | — 3 | 22.6 | 3.36 | 14.0 |
| Reading | 57 | —13 | 22.2 | 3.71 | ...... |
| Renovo *a* | 50 | —19 | 18.6 | 3.86 | 22.3 |
| Saegerstown | 56 | —35 | 17.4 | 4.60 | 17.5 |
| St. Marys | 46 | —19 | 16.2 | 4.50 | 19.0 |
| Saltsburg | ...... | ...... | ...... | 3.40 | 18.6 |
| Seisholtzville | ...... | ...... | ...... | 3.57 | ...... |
| Selinsgrove | 50 | — 24 | 19.2 | 3.99 | 27.5 |
| Shawmont | ...... | ...... | ...... | 3.07 | ...... |
| Skidmore | 57 | —20 | 18.8 | 2.60 | 13.0 |
| Smethport | 51 | —42 | 16.5 | ...... | ...... |
| Smiths Corners | ...... | ...... | ...... | 3.23 | ...... |
| Somerset | 56 | —20 | 20.1 | 5.82 | 40.6 |
| South Eaton | 54 | —25 | 18.6 | 2.97 | 12.5 |
| Springmount | ...... | ...... | ...... | 3.51 | ...... |
| State College | 52 | —15 | 18.4 | 2.72 | 16.5 |
| Sunbury | ...... | ...... | ...... | 5.00 | 35.0 |
| Towanda | 54 | —31 | 16.3 | 2.72 | 14.5 |
| Troutrun | ...... | ...... | ...... | 3.97 | 29.0 |
| Uniontown | 66 | —10 | 26.0 | 2.83 | 15.0 |
| Warren | 55 | —26 | 18.2 | 2.52 | 19.2 |
| Wellsboro | 48 | —25 | 17.4 | 2.95 | 20.0 |
| Westchester | 53 | — 5 | 24.2 | 3.82 | 11.7 |
| West Newton | ...... | ...... | ...... | 3.30 | 15.0 |
| Wilkesbarre | 54 | —18 | 19.8 | 2.86 | 19.0 |
| Williamsport | 55 | —17 | 19.4 | 3.64 | 23.2 |
| York | 56 | —15 | 23.8 | 4.39 | 34.0 |
| *Rhode Island.* | | | | | |
| Bristol | 44 | — 5 | 23.1 | 4.56 | 25.5 |
| Kingston | 48 | —16 | 20.6 | 5.45 | 24.5 |
| Pawtucket | 46 | —18 | 19.3 | 5.90 | 31.0 |
| Providence *a* | 50 | — 4 | 23.2 | 6.45 | 31.0 |
| Providence *c* | 50 | — 8 | 21.4 | 5.37 | 28.0 |
| *South Carolina.* | | | | | |
| Aiken | 70 | 17 | 40.8 | 2.85 | T. |
| Allendale | 70 | 21 | 44.8 | 3.30 | |
| Anderson | 65 | 15 | 39.4 | 2.01 | 2.0 |
| Barksdale | 66 | 15 | 39.6 | 1.90 | |
| Batesburg | 69 | 14 | 40.5 | 3.64 | T. |
| Beaufort | 66 | 22 | 46.2 | 4.01 | |
| Bennettsville | 70 | 11 | 42.0 | 0.82 | 1.0 |
| Blackville | 72 | 17 | 41.4 | 2.53 | 0.2 |
| Bowman | 69 | 15 | 42.6 | 4.26 | 1.0 |
| Calhoun Falls | ...... | ...... | ...... | 1.59 | |
| Camden | ...... | ...... | ...... | 3.50 | 0.9 |
| Cheraw *a* | 70 | 14 | 37.8 | 3.20 | T. |
| Cheraw *b* | ...... | ...... | ...... | 2.95 | 0.9 |
| Clarks Hill | 68 | 17 | 41.0 | 2.97 | T. |
| Clemson College | 65 | 8 | 38.1 | 3.84 | 3.0 |
| Conway | 71 | 10 | 40.2 | 3.03 | 3.6 |
| Darlington | 72 | 8 | 40.8 | 2.49 | 2.5 |
| Due West | 65 | 16 | 39.4 | 2.32 | |
| Effingham | ...... | ...... | ...... | 3.20 | 3.0 |
| Florence | 72 | 9 | 40.2 | 2.12 | 2.0 |
| Gaffney | 65 | 10 | 36.2 | 1.50 | 3.0 |
| Georgetown | 70 | 17 | 41.8 | 3.50 | 2.5 |
| Gillisonville | 72 | 19 | 44.2 | 4.36 | T. |
| Greenville | 62 | 9 | 34.0 | 2.25 | 3.5 |
| Greenwood | 66 | 16 | 36.6 | 2.41 | |
| Heath Springs | 66 | 11 | 37.4 | 4.56 | |
| Kingstree *a* | 70 | 18 | 41.2 | 3.78 | 2.5 |
| Kingstree *b* | ...... | ...... | ...... | 3.78 | 2.6 |
| Liberty | 64 | 10 | 38.6 | 2.94 | 3.0 |
| Little Mountain | 67 | 15 | 39.8 | 2.63 | T. |
| Lugoff | 68 | 12 | 38.2 | 3.55 | T. |
| Newberry | 68 | 14 | 38.6 | 3.66 | 0.5 |
| Pinopolis*[1] | 65 | 22 | 43.0 | 4.19 | 1.0 |
| St. Georges | 67 | 18 | 41.2 | 2.45 | 1.1 |
| St. Matthews | 68 | 18 | 40.8 | 3.47 | 1.5 |
| St. Stephens | ...... | ...... | ...... | 3.40 | 2.0 |
| Saluda | 68 | 12 | 40.1 | 2.82 | |
| Santuck | 66 | 9 | 38.0 | 2.35 | 0.2 |
| Smiths Mills | ...... | ...... | ...... | 3.15 | 3.0 |
| Society Hill | 70 | 16 | 39.2 | 3.07 | 1.5 |
| Spartanburg | 64 | 10 | 35.9 | 1.37 | 3.0 |
| Statesburg | 69 | 15 | 42.0 | 2.22 | 1.0 |
| Summerville | 68 | 20 | 40.0 | 4.78 | 0.5 |
| Trenton | 64[d] | 17[d] | 40.2[d] | 2.69 | T. |
| Trial | 70 | 12 | 41.0 | 3.87 | 5.0 |
| Walhalla | 65 | 12 | 38.4 | 3.40 | 5.5 |
| Walterboro | 72 | 20 | 45.5 | 3.83 | T. |
| Winnsboro | 68 | 17 | 40.4 | 2.92 | T. |
| Winthrop College | 65 | 13 | 38.4 | 1.08 | 1.0 |
| Yemassee | 74 | 21 | 43.3 | 4.65 | |
| Yorkville | 66 | 15 | 40.0 | 1.91 | 1.0 |
| *South Dakota.* | | | | | |
| Aberdeen | 40 | —34 | 5.3 | 0.43 | 3.2 |
| Academy | 48 | —24 | 17.0 | 0.28 | 3.4 |
| Alexandria | 40 | —28 | 9.7 | 0.30 | 3.0 |
| Armour | 50 | —25 | 15.2 | 0.54 | 5.5 |
| Ashcroft | 60 | —21 | 22.8 | 0.80 | 8.0 |
| Bowdle | 37 | —33 | 7.6 | 0.10 | 1.0 |

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

| Stations. | Temperature. (Fahrenheit.) Maximum. | Minimum. | Mean. | Precipitation. Rain and melted snow. | Total depth of snow. |
|---|---|---|---|---|---|
| *South Dakota*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Brookings | 37 | —34 | 7.0 | 0.04 | 0.4 |
| Canton | 41 | —27 | 12.0 | 0.07 | 1.0 |
| Cavite | 68 | —22 | 17.9 | 0.25 | 2.5 |
| Centerville | ..... | ..... | ..... | 0.44 | 4.7 |
| Chamberlain | 47 | —21 | 16.0 | 0.18 | 2.5 |
| Cherrycreek | 56 | —27 | 18.6 | 0.31 | ..... |
| Clark | 36 | —29 | 6.2 | 0.15 | 1.5 |
| Clear Lake | 34 | —34 | 7.2 | 0.07 | |
| Desmet | 43 | —33 | 8.3 | 0.20 | 2.0 |
| Doland | 38 | —35 | 6.2 | 0.12 | 1.2 |
| Elkpoint | 47 | —23 | 16.7 | 0.39 | 6.0 |
| Fairfax | 46 | —21 | 18.0 | T. | T. |
| Farmingdale | ..... | ..... | ..... | 0.51 | 5.0 |
| Faulkton | 37 | —30 | 8.1 | 0.10 | ..... |
| Flandreau | 36 | —32 | 7.8 | 0.21 | 2.1 |
| Forestburg | 38 | —32 | 7.9 | 0.08 | 0.8 |
| Fort Meade | 61 | —17 | 26.4 | 0.26 | ..... |
| Gannvalley | 39 | —27 | 11.0 | 0.25 | 5.0 |
| Gettysburg | 38 | —33 | 7.0 | 0.43 | 4.5 |
| Grand River School | 44 | ..... | ..... | 0.31 | 3.8 |
| Greenwood | 53 | —19 | 19.6 | 0.60 | 4.0 |
| Highmore | 39 | —27 | 11.4 | 0.15 | 1.5 |
| Hotch City | 45 | —28 | 14.6 | 0.11 | 1.5 |
| Howard | 37 | —31 | 9.2 | 0.30 | 3.0 |
| Howell | 38 | —32 | 8.4 | 0.09 | 2.5 |
| Ipswich | 35 | —36 | 5.0 | 0.20 | 2.0 |
| Kidder | 36 | —39 | 4.9 | T. | T. |
| Kimball | 42 | —26 | 13.0 | 0.50 | 5.0 |
| Leola | 35 | —36 | 6.6 | 0.20 | 4.0 |
| Marion | 40 | —28 | 11.6 | 0.10 | ..... |
| Mellette | 37 | —35 | 6.8 | 0.24 | 2.4 |
| Menno | 45 | —27 | 13.6 | 0.34 | 2.3 |
| Mitchell | 40 | —28 | 11.3 | 0.04 | 0.5 |
| Oelrichs | 62 | —16 | 22.0 | 0.70 | 7.0 |
| Pedro | 55 | —20 | 20.8 | 0.30 | 3.5 |
| Pine Ridge | 62 | —17 | 23.6 | 0.16 | 1.5 |
| Plankinton | 40[g] | —28 | 12.3[g] | 0.15 | 1.5 |
| Ramsey | 38 | —37 | 7.0 | 0.15 | 1.5 |
| Redfield | 36 | —34 | 5.7 | 0.07 | 1.0 |
| Silver City | ..... | ..... | ..... | 1.60 | 16.0 |
| Sioux Falls | 41 | —32 | 9.4 | 0.13 | 2.5 |
| Sisseton Agency | 35 | —36 | 6.8 | 0.30 | 3.0 |
| Spearfish | 56 | —12 | 26.6 | 0.85 | 10.0 |
| Stephan | 38 | —26 | 10.4 | 0.29 | 3.0 |
| Tyndall | 48 | —25 | 16.0 | 0.49 | 4.2 |
| Watertown | 36 | —36 | 5.2 | 0.20 | 2.2 |
| Wentworth | 37 | —33 | 8.0 | 0.26 | 2.2 |
| Wolsey | ..... | ..... | ..... | 0.26 | 2.7 |
| *Tennessee.* | | | | | |
| Andersonville | 66 | 6 | 35.5 | 3.60 | 4.5 |
| Ashwood | 66 | 10 | 37.0 | 4.02 | 2.5 |
| Bluff City | ..... | ..... | ..... | 2.24 | 5.5 |
| Bolivar | 63 | 8 | 35.5 | 3.31 | 3.1 |
| Bristol | 62 | 3 | 30.8 | 1.87 | 5.5 |
| Byrdstown | 62 | 8 | 34.8 | 3.52 | 4.2 |
| Carthage | 66 | 10 | 36.2 | 1.49 | 1.0 |
| Catlettsburg | ..... | ..... | ..... | 3.10 | 2.9 |
| Cedar Hill | 63 | 6 | 36.4 | 4.35 | 1.5 |
| Celina | ..... | ..... | ..... | 2.82 | ..... |
| Charleston | ..... | ..... | ..... | 2.34 | 2.0 |
| Clarksville | 62 | 6 | 35.8 | 3.69 | 1.8 |
| Clinton | ..... | ..... | ..... | 3.36 | 3.0 |
| Covington | 62 | 7 | 38.2 | 3.80 | 2.0 |
| Decatur | 66 | 9 | 35.7 | 3.16 | 7.0 |
| Dickson | 62[c] | 7[c] | 35.4[c] | 3.45 | 1.0 |
| Dover | 67 | 5 | 37.2 | 4.06 | 3.5 |
| Dyersburg | 62 | 4 | 35.0 | ..... | ..... |
| Elizabethton | 64 | 8 | 35.2 | 2.06 | 6.7 |
| Erasmus | 54[g] | 3[g] | 30.8[g] | 3.52 | 4.8 |
| Florence | 63 | 10 | 36.2 | 2.85 | 4.5 |
| Franklin | 61 | 11 | 35.6 | 4.13 | 2.5 |
| Grace | ..... | ..... | ..... | 3.60 | 8.0 |
| Greeneville | 65 | 10 | 34.8 | 2.09 | 6.2 |
| Halls Hill | ..... | ..... | ..... | 2.54 | 4.4 |
| Harriman | 57 | 10 | 33.2 | 3.88 | 4.9 |
| Hohenwald | 63 | 5 | 35.5 | 4.94 | 1.7 |
| Iron City | 63 | 7 | 36.8 | 2.81 | 5.5 |
| Isabella | 64 | 11 | 34.6 | 3.50 | 0.5 |
| Jackson | 64 | 5 | 38.0 | 3.89 | T. |
| Johnsonville | 63 | 6 | 37.1 | 3.86 | 1.3 |
| Jonesboro | 65 | 4 | 33.6 | 2.33 | 9.1 |
| Kenton | 62 | 4 | 37.2 | 4.72 | 1.0 |
| Kingston | ..... | ..... | ..... | 2.82 | T. |
| Lafayette | 62 | 5 | 33.8 | 3.29 | 2.4 |
| Leadvale | ..... | ..... | ..... | 2.60 | 4.0 |
| Lewisburg | 63 | 12 | 38.1 | 2.62 | 3.4 |
| Liberty | 64 | 9 | 36.4 | 2.73 | 1.9 |
| Lynnville | 62 | 11 | 37.0 | 2.95 | 2.5 |
| McMinnville | 61 | 10 | 35.9 | 2.40 | 6.4 |
| Maryville | 68 | 11 | 37.3 | 2.95 | 4.8 |
| Newport | 71 | 12 | 34.5 | 2.46 | 6.0 |
| Palmetto | 62 | 11 | 36.6 | 2.11 | 0.8 |
| Pope | 64 | 6 | 37.9 | 3.75 | T. |
| Rogersville | 67 | 10 | 34.2 | 2.41 | 3.0 |
| Rugby | 65 | 3 | 31.4 | 3.89 | 4.0 |
| Savannah | 64 | 10 | 39.1 | 3.38 | 2.0 |
| Sewanee | 59 | 8 | 33.8 | 4.24 | 4.0 |
| Silverlake | 55 | 3 | 30.2 | 3.04 | 11.4 |

| Stations. | Temperature. (Fahrenheit.) Maximum. | Minimum. | Mean. | Precipitation. Rain and melted snow. | Total depth of snow. |
|---|---|---|---|---|---|
| *Tennessee*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Springdale | 68 | 8 | 33.2 | 2.94 | 8.0 |
| Springville | 62 | 5 | 37.0 | 3.99 | 2.2 |
| Tazewell | ..... | ..... | ..... | 2.90 | 5.5 |
| Tellico Plains | 66 | 11 | 38.5 | 2.98 | 1.3 |
| Tracy City | 65 | 4 | 33.6 | 3.98 | 4.2 |
| Trenton | 65 | 6 | 39.3 | 5.05 | 1.0 |
| Tullahoma | 62 | 10 | 36.4 | 3.02 | 4.6 |
| Waynesboro | 65 | 10 | 38.8 | 3.99 | 3.0 |
| Wildersville | 62 | 10 | 38.0 | 4.70 | 1.5 |
| Yukon | 62 | 11 | 38.2 | 2.36 | 1.1 |
| *Texas.* | | | | | |
| Albany | 72 | 12 | 41.6 | 0.90 | |
| Alvin | 76 | 25 | 51.3 | 1.70 | |
| Arthur | ..... | ..... | ..... | 1.92 | 2.0 |
| Athens | 80 | 12 | 42.1 | 0.00 | |
| Austin *a* | 78 | 20 | 49.6 | 0.00 | |
| Ballinger | 77 | 14 | 41.6 | 0.65 | |
| Beaumont | 81 | ..... | ..... | 1.02 | |
| Beeville | 85 | 26 | 53.6 | 0.25 | |
| Bigspring | 74 | 10 | 43.7 | 0.25 | T. |
| Blanco | 80 | 15 | 44.4 | T. | |
| Boerne *[1] | 75 | 18 | 47.0 | 0.12 | |
| Bonham | 67 | 9 | 41.1 | 2.26 | 4.0 |
| Booth | ..... | ..... | ..... | 1.50 | |
| Bowie | 78 | 8 | 42.4 | 1.42 | 2.0 |
| Brazoria | 79 | 24 | 50.5 | ..... | |
| Brenham | 77 | 19 | 48.7 | 0.41 | T. |
| Brighton | 78 | 30 | 55.6 | 0.19 | |
| Brownwood | 79 | 15 | 48.3 | 2.00 | |
| Burnet | 79 | 14 | 47.8 | 0.45 | |
| Camp Eagle Pass | 87 | 11 | 51.6 | 0.00 | |
| Childress | 75 | 4 | 39.2 | T. | T. |
| Coleman | 82 | 15 | 48.6 | 0.65 | |
| College Station | 77 | 16 | 49.8 | 1.27 | 0.2 |
| Colorado | 79[f] | 6 | 45.4[e] | 1.68 | |
| Columbia | 77 | 23 | 51.4 | 1.33 | |
| Columbus | ..... | ..... | ..... | 0.18 | |
| Comanche | 80[c] | 6[c] | 46.7[c] | 0.70 | |
| Comstock | 81 | 17 | 51.2 | 0.00 | |
| Corsicana | 79 | 12 | 44.8 | 1.39 | |
| Cotulla | 73 | 20 | 49.0 | 0.00 | |
| Cuero | 79 | 23 | 49.2 | 0.13 | T. |
| Dallas | 75 | 10 | 42.2 | 1.68 | 0.4 |
| Danevang | 78 | 24 | 51.8 | 0.70 | |
| Dialville | 74 | 13 | 46.2 | 1.58 | T. |
| Dublin | 80 | 13 | 44.2 | 1.00 | |
| Duval | 82 | 18 | 50.0 | T. | |
| Estelle | 76 | 10 | 44.0 | 1.11 | 0.5 |
| Fort Brown | 86 | 32 | 59.4 | 0.40 | |
| Fort Clark | 82 | 19 | 49.6 | T. | |
| Fort Davis | 71 | 8 | 43.4 | 0.45 | T. |
| Fort McIntosh | 86 | 22 | 54.4 | 0.05 | |
| Fort Ringgold | 91 | 25 | 57.5 | 0.02 | |
| Fort Stockton | ..... | ..... | ..... | 0.00 | |
| Fredericksburg | 75 | 12 | 46.2 | 0.07 | |
| Gainesville | 73 | 10 | 40.4 | 1.60 | 2.0 |
| Grapevine | ..... | ..... | ..... | 1.42 | 1.0 |
| Greenville | 72 | 9 | 42.2 | 1.15 | 0.1 |
| Hale Center | 70 | 6 | 40.2 | 0.00 | |
| Hallettsville | 79 | 22 | 53.6 | 0.13 | |
| Haskell | 80 | 11 | 42.9 | 0.53 | 1.5 |
| Hearne | 74 | 22 | 53.6 | 0.07 | T. |
| Hempstead | ..... | ..... | ..... | 0.93 | 0.1 |
| Henrietta | 78 | 8 | 40.6 | 2.93 | 6.0 |
| Hewitt | ..... | ..... | ..... | 0.40 | |
| Hillsboro | 73 | 10 | 44.2 | 0.60 | |
| Hondo | ..... | ..... | ..... | 0.04 | |
| Houston | 77 | 22 | 49.0 | 0.30 | |
| Huntsville | 79 | 18 | 45.8 | 1.63 | T. |
| Ira | 78 | 12[c] | 43.4 | 0.34 | T. |
| Jasper | 80[g] | 23 | 51.6[d] | 1.68 | 1.5 |
| Jefferson | 73 | 13 | 44.6 | 2.12 | |
| Jewett | ..... | 28 | ..... | 0.06 | |
| Kaufman | 74 | 11 | 45.6 | 1.57 | T. |
| Kent | 79 | 14 | 46.4 | 0.00 | |
| Kerrville | 73 | 30 | 52.0 | T. | |
| Knickerbocker [f] | 81 | 13 | 48.2 | 0.68 | |
| Kopperl | ..... | ..... | ..... | 0.60 | |
| Lampasas | 78 | 9 | 44.0 | 0.00 | |
| Lapara | ..... | ..... | ..... | 0.00 | |
| Laureles Ranch | ..... | ..... | ..... | 0.05 | |
| Liberty | ..... | ..... | ..... | 0.08 | |
| Llano | 80 | 20 | 49.3 | 0.00 | |
| Longview | 76 | 13 | 43.6 | 0.47 | |
| Luling | 78 | 18 | 48.4 | 0.06 | |
| McKinney | 72 | 8 | 44.5 | 1.37 | 0.5 |
| Mann | 75[c] | 11[b] | 46.6[b] | 0.48 | |
| Marlin | 78 | 14 | 45.8 | 0.14 | |
| Menardville | ..... | ..... | ..... | 0.00 | |
| Mount Blanco | 72 | 2 | 38.1 | 0.00 | |
| Nacogdoches | 73 | 15 | 44.2 | 1.86 | 0.8 |
| New Braunfels | 76 | 20 | 50.6 | 0.24 | |
| Orange | ..... | ..... | ..... | 0.40 | |
| Panter | ..... | ..... | ..... | 1.37 | |
| Paris | 72 | 7 | 42.4 | 1.90 | 4.5 |
| Pearsall | 82 | 21 | 51.9 | T. | |
| Pecos | 79 | 8 | 46.0 | 0.20 | |
| Rhineland | 78 | 7 | 39.8 | 0.20 | 2.0 |

| Stations. | Temperature. (Fahrenheit.) Maximum. | Minimum. | Mean. | Precipitation. Rain and melted snow. | Total depth of snow. |
|---|---|---|---|---|---|
| *Texas*—Cont'd. | ° | ° | ° | *Ins.* | *Ins.* |
| Riverside | ..... | ..... | ..... | 1.27 | ..... |
| Rockisland | 78[c] | 21[c] | 51.9[c] | 0.33 | |
| Rockland | ..... | ..... | ..... | 2.10 | 2.0 |
| Rockport | 72 | 34 | 55.8 | 0.00 | |
| Runge | 80[g] | 22[g] | 53.8[g] | T. | |
| Sabinal [g] | 88 | 16 | 53.5 | 0.00 | |
| Sabine | 70 | 24 | 50.6 | 3.29 | |
| San Saba | 82 | 8 | 46.2 | 0.07 | |
| Santa Gertrudes Ranch | ..... | ..... | ..... | T. | |
| Sherman | 73 | 12 | 47.4 | 2.00 | 2.0 |
| Sonora | 79 | 5 | 45.4 | 0.12 | |
| Sugarland | 80 | 23 | 51.8 | 0.75 | |
| Sulphur Springs | 70 | 9 | 43.8 | 2.21 | 0.2 |
| Temple *a* | 77 | 13 | 45.3 | 0.27 | |
| Temple *b* | 76 | 12 | 44.6 | 0.20 | |
| Tilden | 86 | 11 | 51.4 | T. | |
| Trinity | 77 | 18 | 48.4 | 1.72 | |
| Tulia | 72 | 3 | 36.4 | 0.00 | |
| Tyler | 75 | 12 | 43.0 | 1.00 | |
| Victoria | 81 | 23 | 52.2 | 0.33 | |
| Waco | 79 | 16 | 46.4 | 1.60 | |
| Waxahachie | 75 | 11 | 42.0 | 1.38 | 0.1 |
| Weatherford | 73 | 11 | 42.2 | 0.94 | T. |
| Wichita Falls | ..... | ..... | ..... | 1.50 | 7.5 |
| *Utah.* | | | | | |
| Alpine | ..... | ..... | ..... | 2.20 | 22.0 |
| Aneth | 54 | 2 | 26.6 | 0.05 | 0.5 |
| Blackrock | 49 | — 6 | 22.7 | 0.41 | 4.1 |
| Bluecreek | 45 | — 7 | 24.4 | 1.00 | 10.0 |
| Callao | 55 | 0 | 25.4 | 1.50 | 15.0 |
| Castledale | 51 | —11 | 17.7 | 1.00 | 10.0 |
| Cisco | 46 | — 3 | 21.4 | 0.10 | 1.0 |
| Corinne | 45 | — 8 | 19.6 | 1.00 | 10.0 |
| Coyoto | 58 | —12 | 21.2 | T. | T. |
| Deseret | 52 | — 6 | 21.2 | 0.15 | 1.5 |
| Emery | 47 | — 4 | 22.6 | T. | |
| Escalante | 48 | — 5 | 24.8 | 0.10 | 1.0 |
| Farmington | 45 | 4 | 24.2 | 2.51 | 25.1 |
| Fillmore | 56 | — 1 | 26.6 | 1.89 | 18.9 |
| Frisco | 53 | 4 | 28.9 | 0.50 | 7.0 |
| Garrison | 56 | 0 | 25.8 | 0.07 | 0.1 |
| Giles | 45 | — 6 | 20.6 | T. | T. |
| Government Creek | 45[i] | — 6 | 24.1[c] | 1.44 | 14.7 |
| Green River | 50 | — 7 | 20.9 | 0.25 | 2.5 |
| Grover | 52 | 3 | 24.8 | T. | T. |
| Heber | 44 | —15 | 14.0 | 2.10 | 21.0 |
| Henefer | 46 | —19 | 16.3 | 2.03 | 22.2 |
| Hite | 55 | 11 | 33.5 | 0.10 | |
| Huntsville | ..... | ..... | ..... | 1.48 | 15.0 |
| Ibapah | 55 | —13 | 22.8 | 0.57 | 5.7 |
| Kanab | ..... | ..... | ..... | 0.10 | 1.0 |
| Kelton | 47 | 2 | 23.4 | 0.10 | 1.0 |
| Levan | 45 | — 5 | 19.2 | 1.71 | 17.1 |
| Loa | 50 | —12 | 21.2 | 0.00 | |
| Logan | 47 | 0 | 22.0 | 1.23 | 12.3 |
| Lund [f] | 50 | — 7 | 24.2 | 0.10 | 1.0 |
| Manti | 58 | —12 | 20.0 | 1.10 | 11.0 |
| Marysvale | 56 | — 4 | 25.7 | 0.29 | 3.0 |
| Meadowville | 39[f] | 2 | 20.4[c] | 1.10 | 11.0 |
| Millville | ..... | ..... | ..... | 1.16 | 11.6 |
| Minersville | 54 | —12 | 24.4 | 0.70 | 7.0 |
| Moab | 51 | 3 | 26.4 | 0.15 | 1.5 |
| Monticello | 44 | 0 | 26.6 | 0.01 | 0.1 |
| Morgan | 46 | —16 | 16.3 | 2.08 | 25.6 |
| Mount Nebo | 47 | — 9 | 20.7 | 0.55 | 8.7 |
| Mount Pleasant | 46 | — 5 | 21.4 | 1.10 | 11.0 |
| Ogden | 46 | 5 | 24.0 | 1.46 | 16.0 |
| Park City [h] | 46 | — 1 | 23.6 | 2.15 | 21.5 |
| Parowan | 49 | — 8 | 24.7 | 0.43 | 6.5 |
| Pinto | 58 | —12 | 21.6 | 0.80 | 8.0 |
| Plateau | 60 | —23 | 17.8 | 1.26 | 13.5 |
| Provo | 46 | —10 | 19.7 | 1.72 | 24.1 |
| Ranch | 59 | — 2 | 25.4 | T. | T. |
| Richfield | 55 | — 3 | 24.4 | 0.55 | 5.5 |
| Rockville | 68 | 0 | 32.4 | 0.00 | |
| St. George | 63 | 4 | 32.2 | T. | T. |
| Salt Air | 49 | 3 | 23.4 | 1.64 | 15.3 |
| Scipio | 55 | —17 | 19.4 | 0.82 | 9.7 |
| Snowville | 46 | —13 | 20.2 | 1.80 | 18.0 |
| Soldier Summit [d] | 44 | —10 | 15.6 | 1.35 | 13.5 |
| Terrace | 42 | 0 | 21.6 | 0.30 | 3.0 |
| Thistle | 50 | —15 | 19.0 | 1.90 | 19.0 |
| Tooele | 49 | 8 | 28.0 | 2.82 | 28.2 |
| Tropic | 60 | 7 | 29.1 | T. | ..... |
| Wellington | 48 | — 7 | 20.9 | 0.35 | 3.5 |
| Woodruff | 44 | —19 | 13.0 | 0.30 | 3.0 |
| *Vermont.* | | | | | |
| Burlington | 40 | —18 | 13.7 | 1.36 | 12.5 |
| Cavendish | 40 | —21 | 11.8 | 2.74 | ..... |
| Chelsea | 42 | —22 | 9.4 | 2.34 | 40.0 |
| Cornwall | 45 | —24 | 10.9 | 1.85 | 13.5 |
| Derby | 39 | —23 | 7.2 | ..... | ..... |
| Enosburg Falls | 47 | —44 | 8.9 | 2.88 | 28.8 |
| Jacksonville | 33 | —31 | 8.5 | 4.79 | 67.0 |
| Manchester | 50 | —30 | 13.4 | 2.00 | 33.0 |
| Morrisville | 37 | —39 | 9.6 | 1.81 | 34.6 |
| Norwich | 39 | —33 | 8.4 | 3.60 | 32.5 |
| St. Johnsbury | 37 | —34 | 7.4 | 1.81 | 23.5 |

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

| Stations. | Temperature. (Fahrenheit.) Maximum. | Temperature. Minimum. | Temperature. Mean. | Precipitation. Rain and melted snow. | Precipitation. Total depth of snow. |
|---|---|---|---|---|---|
| | ° | ° | ° | *Ins.* | *Ins.* |
| *Vermont*—Cont'd. | | | | | |
| Wells | 46 | —21 | 10.8 | 2.38 | 22.0 |
| Woodstock | 55 | —38 | 13.4 | 1.78 | 40.0 |
| *Virginia.* | | | | | |
| Ashland | 64 | 2 | 31.6 | 1.85 | 9.0 |
| Barboursville | 62 | — 2 | 31.8 | 2.34 | 14.0 |
| Bigstone Gap | 65 | 9 | 32.5 | 3.54 | 9.5 |
| Blacksburg | 60 | — 6 | 29.0 | 1.90 | 8.5 |
| Boykins | ..... | ..... | ..... | 1.75 | 4.5 |
| Buckingham | 65 | 5 | 32.4 | 2.52 | 11.5 |
| Burkes Garden | 55 | —14 | 26.2 | 2.92 | 8.0 |
| Callaville | 67[c] | 8[c] | 31.9[c] | 3.55 | 9.0 |
| Charlottesville | 61 | 4 | 31.8 | 1.95 | 10.0 |
| Clarksville | ..... | ..... | ..... | 3.63 | 15.0 |
| Columbia | ..... | ..... | ..... | 2.00 | 10.0 |
| Dale Enterprise | 62 | — 6 | 27.8 | 2.19 | 16.0 |
| Danville | ..... | ..... | ..... | 2.16 | 8.5 |
| Elk Knob | 61 | 2 | 32.2 | 3.89 | 8.0 |
| Fredericksburg | 67 | 2 | 29.8 | 1.86 | 9.2 |
| Hampton | 68 | 14 | 35.4 | 3.46 | 7.5 |
| Hot Springs | 57 | — 1 | 25.8 | 2.45 | 11.0 |
| Lexington | 62 | — 1 | 30.2 | 1.87 | 12.8 |
| Lincoln | 54 | —10 | 23.2 | 1.87 | 17.0 |
| Marion | ..... | ..... | ..... | 2.15 | 7.0 |
| McDowell | 55 | — 9 | 27.2 | 1.48 | 10.2 |
| Mendota | ..... | ..... | ..... | 2.41 | 4.5 |
| Newport News | 70 | 8 | 38.4 | 3.10 | 9.5 |
| Petersburg | 64 | 6 | 33.1 | 2.07 | 9.5 |
| Quantico | 51 | 1 | 26.1 | ..... | ..... |
| Radford | ..... | ..... | ..... | 1.26 | 11.0 |
| Riverton | ..... | ..... | ..... | 1.29 | 13.0 |
| Roanoke | 58 | 2 | 28.8 | 2.25 | 12.5 |
| Rockymount | 57 | — 2 | 28.2 | 1.61 | 11.8 |
| Saxe | 65 | 8 | 33.8 | 2.30 | 7.8 |
| Shenandoah | ..... | ..... | ..... | 1.37 | 11.8 |
| Speers Ferry | ..... | ..... | ..... | 3.28 | 6.0 |
| Spottsville | 68 | 8 | 35.0 | 2.64 | 7.0 |
| Stanardsville | 60 | 1 | 26.6 | 4.27 | 28.0 |
| Staunton | 60 | — 4 | 30.3 | 1.90 | 15.0 |
| Stephens City | 63 | — 5 | 27.6 | 2.03 | 19.0 |
| Warsaw | 67[c] | 5[c] | 33.2[c] | 1.15 | 6.0 |
| Wilkerson | 67 | 4 | 30.6 | 1.80 | 4.9 |
| Williamsburg | 67[f] | 8[f] | 33.4[f] | 3.67 | 5.8 |
| Woodstock | 63 | — 3 | 27.6 | 1.98 | 16.9 |
| Wytheville | 59 | 2 | 30.8 | 1.70 | 7.0 |
| *Washington.* | | | | | |
| Aberdeen | 54 | 28 | 40.4 | 13.48 | 2.2 |
| Anacortes | ..... | ..... | ..... | 4.43 | |
| Ashford | ..... | ..... | ..... | 6.49 | 21.0 |
| Brinnon | 54 | 26 | 38.7 | 9.36 | 7.2 |
| Blaine | 53 | 19 | 39.0 | 6.14 | 5.5 |
| Cedonia | 44 | 9 | 28.5 | 1.39 | 12.4 |
| Centralia | 54 | 27 | 39.9 | 5.84 | 1.2 |
| Cheney | 47 | 20 | 34.1 | 1.97 | 17.0 |
| Clearbrook | 58 | 17 | 37.0 | 6.45 | 2.0 |
| Clearwater | 54 | 28 | 39.6 | 16.77 | 3.5 |
| Cle Elum | 52 | 7 | 32.4 | 3.96 | 24.0 |
| Colville | 49 | — 9 | 26.6 | 2.10 | 17.1 |
| Conconully | 45 | — 6 | 23.9 | 1.41 | 14.1 |
| Coupeville | 55 | 24 | 41.8 | 2.38 | 1.0 |
| Crescent | 45 | 10 | 28.5 | 1.32 | 6.5 |
| Danville | 47 | 3 | 25.0 | 1.62 | 18.3 |
| Dayton | 57 | 15 | 37.2 | 2.32 | 9.0 |
| East Sound | 52[g] | 20[g] | 37.9[g] | 5.37 | 6.0 |
| Ellensburg | 54 | 8 | 32.0 | 0.56 | 4.5 |
| Ephrata | 50 | 11 | 29.4 | 0.15 | 1.5 |
| Grandmound | 55 | 21 | 40.2 | 6.73 | 3.0 |
| Granite Falls | ..... | ..... | ..... | 5.39 | 3.5 |
| Horseheaven | ..... | ..... | ..... | 0.88 | 3.0 |
| Lacenter | 56 | 28 | 39.2 | 7.22 | 4.0 |
| Lakeside | 48 | 9 | 27.2 | 1.54 | 15.5 |
| Lind | 52 | 12 | 32.2 | 1.09 | 4.0 |
| Loomis | 46 | 5 | 26.2 | 1.20 | 7.0 |
| Mayfield | 55 | 28 | 39.7 | 7.83 | 7.0 |
| Mottinger Ranch | 61 | 21 | 37.8 | 1.17 | 6.0 |
| Mount Pleasant | 57 | 30 | 40.3 | 8.70 | T. |
| Moxee | 58 | 15 | 33.9 | 0.19 | ..... |
| Northport | 45 | — 1 | 25.0 | 2.12 | 21.2 |
| Odessa | 49 | 12 | 31.4 | 0.83 | 5.0 |
| Olga | 52 | 23 | 41.0 | 4.92 | 3.0 |
| Olympia | 56 | 27 | 41.2 | 7.88 | 1.0 |
| Pinehill | 57 | 24 | 38.7 | 2.63 | 5.0 |
| Pomeroy | 58 | 10 | 35.6 | 2.99 | 19.8 |
| Port Townsend | 57 | 28 | 41.4 | 2.10 | T. |
| Pullman | 47 | 13 | 31.0 | 2.24 | 22.4 |
| Rattlesnake | 48[c] | 9[c] | 30.1[c] | 0.69 | 3.4 |
| Republic | 45 | —10 | 24.3 | 1.78 | 15.8 |
| Ritzville | ..... | ..... | ..... | 0.93 | 5.5 |
| Ritzville (near) | ..... | ..... | ..... | 1.13 | 6.0 |
| Rosalia | 46 | 12 | 30.6 | 1.64 | 11.0 |
| Sedro-Woolley | 57 | 16 | 39.5 | 6.08 | 7.0 |
| Silvana | 56 | 19 | 39.7 | 4.98 | 4.0 |
| Snohomish | 55 | 23 | 39.6 | 5.97 | 2.0 |
| Snoqualmie | 53 | 24 | 39.8 | 9.07 | T. |
| Southbend | 55 | 29 | 41.6 | 12.01 | 2.0 |
| South Ellensburg | 52 | 10 | 31.1 | 0.57 | 5.5 |
| Sprague | ..... | ..... | ..... | 1.50 | 1.0 |
| Sunnyside | 60 | 16 | 34.2 | 0.23 | 1.0 |
| Trinidad | 53 | 11 | 31.0 | 0.60 | 6.0 |
| *Washington*—Cont'd. | | | | | |
| Twisp | 40 | — 5 | 17.8 | 1.70 | 23.0 |
| Union | 57[d] | 27[c] | 40.6[d] | 10.07 | 5.5 |
| Usk | 41 | — 1 | 27.7 | 2.07 | 13.8 |
| Vancouver | 57 | 28 | 40.9 | 4.49 | 2.0 |
| Vashon | 54 | 21 | 41.1 | 5.78 | T. |
| Waterville | 43 | — 1 | 23.6 | 1.52 | 15.2 |
| Wenatchee (near) | 51 | 4 | 28.4 | 1.40 | 16.9 |
| Whatcom | 56 | 18 | 40.6 | 4.54 | 5.0 |
| Wilbur | 46 | 2 | 25.4 | 0.97 | 4.8 |
| Zindel | 59 | 20 | 37.8 | 0.54 | 4.2 |
| *West Virginia.* | | | | | |
| Bayard | 58 | —13 | 22.5 | 3.25 | ..... |
| Bens Run | 62 | — 7 | 23.6 | 2.12 | 7.0 |
| Beverly | 59 | — 5 | 26.1 | 4.10 | 16.0 |
| Bluefield | 60 | 1 | 31.2 | 2.52 | 24.0 |
| Buckhannon | 65 | — 4 | 27.0 | 2.84 | 7.0 |
| Burlington | 53 | —13 | 23.2 | 2.40 | 17.0 |
| Cairo | 65 | — 7 | 26.4 | 2.75 | 4.0 |
| Central | 64 | — 7 | 26.1 | 2.27 | 9.8 |
| Charleston | ..... | ..... | ..... | 1.68 | 4.9 |
| Creston | 55 | — 4 | 26.2 | 2.12 | 6.5 |
| Cuba | 67 | — 6 | 27.7 | 2.12 | 5.1 |
| Elkhorn | 64 | 3 | 32.4 | 2.78 | 3.0 |
| Glenville | 67 | — 2 | 28.0 | 2.81 | 9.6 |
| Grafton | 68 | — 3 | 28.4 | 2.54 | 14.9 |
| Green Sulphur Springs | 61 | 0 | 28.6 | 1.98 | 8.0 |
| Harpers Ferry | ..... | ..... | ..... | 2.21 | 19.8 |
| Hinton | ..... | ..... | ..... | 2.14 | 7.7 |
| Huntington | 67 | 6 | 29.2 | 1.78 | 4.2 |
| Leonard | 52 | — 3 | 27.2 | 4.96 | 21.0 |
| Lewisburg | 55 | 2 | 28.4 | 1.83 | 9.0 |
| Logan | 72 | 7 | 35.2 | 4.57 | 6.0 |
| Lost Creek | 65 | — 6 | 25.4 | 4.26 | 5.0 |
| Mannington | 65 | —15 | 25.4 | 1.95 | 7.8 |
| Marlinton | 53 | — 6 | 23.0 | 4.11 | 10.5 |
| Martinsburg | 49 | —12 | 21.9 | 2.05 | 13.0 |
| Moorefield | 65 | — 2 | 27.7 | 1.39 | 11.5 |
| Morgantown | 67 | —10 | 27.2 | 2.70 | 14.0 |
| Moscow | 63 | —18 | 22.8 | 3.30 | 11.0 |
| Moundsville | 65 | —14 | 24.6 | 1.36 | 4.3 |
| New Martinsville | 65 | —11 | 27.1 | 1.95 | 8.5 |
| Nuttallburg | 64 | 10 | 32.6 | 3.80 | 22.0 |
| Parsons | 64 | 0 | 25.4 | 3.65 | 14.0 |
| Philippi | 66 | — 6 | 27.6 | 3.11 | 6.8 |
| Pickens | 59 | —13 | 27.4 | 5.82 | 34.0 |
| Point Pleasant | 67 | 3 | 30.8 | 1.58 | 2.0 |
| Princeton | 57 | 2 | 30.4 | 3.75 | 20.0 |
| Romney | 49 | —11 | 22.5 | 1.90 | 9.0 |
| Rowlesburg | ..... | ..... | ..... | 3.61 | 16.6 |
| Ryan | 70 | — 3 | 29.0 | 2.18 | 7.8 |
| Southside | 70 | 5 | 32.8 | 1.74 | 4.6 |
| Spencer | 70 | — 3 | 29.8 | 2.61 | 8.5 |
| Terra Alta | 60 | 2 | 24.0 | 3.20 | 20.0 |
| Uppertract | 60 | — 2 | 29.0 | 1.70 | 4.2 |
| Valley Fork | 67 | — 2 | 30.1 | 3.28 | 12.5 |
| Webster Springs | 65 | 1 | 30.4 | 4.50 | 31.0 |
| Wellsburg | 61 | — 8 | 21.7 | 2.71 | 12.0 |
| Weston | ..... | ..... | ..... | 3.09 | 11.1 |
| Wheeling *a* | ..... | ..... | ..... | 2.07 | 11.0 |
| Wheeling *b* | 64 | — 8 | 28.8 | 2.54 | 6.0 |
| Williamson | 72 | 7 | 34.1 | 2.36 | 0.8 |
| *Wisconsin.* | | | | | |
| Amherst | 36 | —31 | 5.8 | 0.40 | 4.0 |
| Antigo | 34 | —31 | 7.8 | 0.20 | 2.0 |
| Appleton | 36 | —28 | 10.4 | 0.57 | 5.9 |
| Appleton Marsh | 38 | —34 | 6.8 | 0.24 | 2.5 |
| Ashland | ..... | ..... | ..... | 0.22 | 2.2 |
| Barron | 38 | —40 | 3.3 | 1.25 | 12.5 |
| Beloit | 38 | —27 | 13.2 | 1.83 | 11.5 |
| Brodhead | 39 | —28 | 11.1 | 0.70 | 7.0 |
| Burnett | 36 | —31 | 7.8 | 0.27 | 3.0 |
| Butternut | 36 | —40 | 2.6 | 0.67 | 6.7 |
| Chilton | 36 | —29 | 8.2 | 1.09 | 11.5 |
| Citypoint | 36 | —35 | 6.4 | 0.32 | 3.0 |
| Darlington | 40 | —31 | 8.4 | 0.80 | 8.0 |
| Dodgeville | 40 | —27 | 12.4 | 0.10 | 1.0 |
| Downing | 38 | —40 | 3.8 | 1.00 | 10.0 |
| Easton | 37 | —36 | 7.0 | 0.37 | 6.0 |
| Eau Claire | 40 | —33 | 7.1 | 0.31 | 3.1 |
| Florence | 33 | —27 | 7.2 | 0.40 | 4.0 |
| Fond du Lac | 38 | —28 | 11.0 | 0.66 | T. |
| Grand Rapids | 36 | —38 | 5.1 | 0.15 | 1.5 |
| Grand River Locks | ..... | ..... | ..... | 0.40 | 8.0 |
| Grantsburg | 40 | —43 | 3.2 | 0.70 | 7.0 |
| Hancock | 35 | —32 | 6.8 | 0.60 | 6.0 |
| Harvey | 38 | —27 | 11.1 | 0.58 | 5.9 |
| Hayward | 36 | —42 | 2.1 | 0.36 | 3.6 |
| Hillsboro | 41 | —39 | 5.9 | 0.55 | 5.5 |
| Koepenick | 34 | —34 | 6.6 | 0.60 | 6.0 |
| Ladysmith | 35 | —42 | 7.8 | 0.80 | 8.0 |
| Lancaster | 40 | —28 | 10.7 | 0.19 | 6.0 |
| Madison | 36 | —26 | 10.6 | 0.30 | 5.0 |
| Manitowoc | 37 | —27 | 12.6 | 0.85 | 12.8 |
| Meadow Valley | 37 | —33 | 5.4 | 0.08 | 1.5 |
| Medford | 37 | —34 | 7.1 | 0.20 | 2.0 |
| Menasha | ..... | ..... | ..... | 0.22 | 6.5 |
| Minocqua | 33 | —46 | 5.6 | 0.41 | 5.0 |
| Neillsville | 36 | —36 | 4.5 | 0.36 | ..... |
| *Wisconsin*—Cont'd. | | | | | |
| New London | 35 | —30 | 8.6 | 0.33 | 4.0 |
| Oconto | 35 | —29 | 9.8 | 0.90 | 9.0 |
| Osceola | 35 | —46 | 3.8 | 0.70 | 7.0 |
| Oshkosh | 36 | —31 | 10.0 | 0.30 | 3.4 |
| Pine River | 36[d] | —32[c] | 9.8[d] | 0.20 | 4.2 |
| Portage | 40 | —28 | 10.7 | 0.23 | 5.0 |
| Port Washington | 37 | —31 | 10.0 | 0.70 | 7.0 |
| Prairie du Chien *a* | 47 | —30 | 13.4 | 0.65 | 10.5 |
| Prairie du Chien *b* | ..... | ..... | ..... | 0.64 | 6.0 |
| Prentice | 34 | —40 | 5.8 | 0.42 | 7.0 |
| Racine | 37 | —24 | 15.8 | 1.75 | 17.5 |
| Sheboygan | 37 | —25 | 14.4 | 0.90 | 9.0 |
| Spooner | 43 | —40 | 4.6 | 0.64 | 6.4 |
| Stanley | 36 | —36 | 6.1 | 0.34 | 3.2 |
| Stevens Point | 36 | —36 | 6.8 | 0.16 | 1.5 |
| Valley Junction | 37 | —31 | 9.5 | 0.18 | 2.5 |
| Viroqua | 37 | —31 | 9.0 | 0.33 | 3.9 |
| Washburn | 38 | —31 | 8.1 | 0.25 | 2.8 |
| Watertown | 38 | —30 | 10.0 | 0.36 | 3.6 |
| Waukesha | 37 | —27 | 12.5 | 0.81 | 7.8 |
| Waupaca | 36 | —30 | 7.6 | 0.23 | 4.0 |
| Wausau | 35 | —31 | 6.2 | 0.34 | 3.4 |
| Whitehall | 37 | —34 | 6.4 | 0.22 | 2.2 |
| *Wyoming.* | | | | | |
| Afton | 41 | —17 | 16.1 | 1.31 | 20.0 |
| Alcova | 47 | —12 | 22.3 | 0.27 | 7.5 |
| Basin | 48 | — 6 | 18.8 | 0.47 | 4.7 |
| Battle | 33 | —11 | 9.0 | ..... | ..... |
| Bedford | 41 | —16 | 15.6 | 1.75 | 17.5 |
| Border | 34 | —24 | 7.8 | | |
| Buffalo | 59 | — 7 | 25.6 | 1.12 | 11.2 |
| Burlington | 50 | — 8 | 19.0 | 0.30 | 3.0 |
| Chugwater | 57 | — 6 | 25.7 | 0.55 | 5.5 |
| Daniel | 38 | —13 | 11.2 | 0.40 | 4.0 |
| Evanston | 42 | — 8 | 16.9 | 0.53 | 5.6 |
| Fontenelle | 40 | —10 | 16.2 | T. | T. |
| Fort Laramie | 58 | —11 | 26.6 | 0.05 | 2.0 |
| Fort Washakie | 56 | —10 | 21.4 | 0.90 | 9.0 |
| Fourbear | 53 | — 5 | 23.0 | 0.26 | 5.0 |
| Griggs | 59 | — 7 | 24.8 | 0.22 | 2.2 |
| Hotsprings | 48 | —10 | 14.6 | 0.30 | 3.0 |
| Hyattville | 53 | — 8 | 22.3 | ..... | ..... |
| Laramie | 50 | —16 | 20.2 | 0.25 | 3.7 |
| Leo | 45 | —18 | 18.5 | 0.70 | 11.0 |
| Lolabama Ranch | 44 | — 4 | 19.8 | 0.29 | 3.0 |
| Lusk | 55 | —15 | 22.0 | 0.20 | 2.0 |
| Marquette | 55 | — 5 | 28.5 | 0.02 | 0.2 |
| Moore | 52 | 0 | 25.2 | 0.39 | 9.1 |
| Moorcroft | 50 | —15 | 20.3 | 0.90 | 9.6 |
| Phillips | 61 | —22 | 25.8 | 0.30 | 3.0 |
| Pine Bluff | 63 | —15[c] | 28.5 | T. | T. |
| Redbank | 50 | — 3 | 23.4 | 0.85 | 9.4 |
| South Pass | 44 | —20 | 16.3 | 0.90 | 9.0 |
| Ten Sleep | 50 | — 2 | 21.0 | 0.75 | 8.0 |
| Thayne | 40 | —20 | 14.6 | 0.93 | 10.0 |
| Wells | 36 | —14 | 9.7 | 0.19 | 5.8 |
| *Porto Rico.* | | | | | |
| Adjuntas | 89 | 50 | 69.9 | 4.84 | |
| Aguirre | 89 | 64 | 77.2 | 1.51 | |
| Arecibo | 84 | 52 | 69.0 | 2.00 | |
| Barros | 85 | 51 | 68.4 | 3.98 | |
| Bayamon | 95 | 60 | 76.2 | 3.00 | |
| Caguas | 88 | 54 | 72.7 | 2.65 | |
| Canovanas | 84 | 66 | 75.4 | 3.53 | |
| Cayey | 82 | 54 | 69.2 | 1.59 | |
| Cidra | 85 | 47 | 67.6 | 9.31 | |
| Coamo | 90 | 53 | 72.0 | 1.58 | |
| Corozal | 89 | 52 | 70.4 | 2.57 | |
| Fajardo | 87 | 64 | 77.2 | 1.93 | |
| Guanica | 90 | 55 | 73.4 | 1.59 | |
| Hacienda Colosa | 89 | 58 | 74.4 | 4.65 | |
| Hacienda Josefa | ..... | ..... | ..... | 1.22 | |
| Hacienda Perla | 89 | 65 | 75.8 | 4.78 | |
| Humacao | 86 | 70 | 77.6 | 3.01 | |
| Isabela | 88 | 60 | 73.4 | 2.48 | |
| La Carmelita | 86 | 59 | 71.6 | 4.38 | |
| La Isolina | 86 | 60 | 73.0 | 3.29 | |
| Lares | 88 | 53 | 70.6 | 3.59 | |
| Las Marias | 91 | 62 | 75.8 | 6.32 | |
| Manati | 88 | 59 | 74.2 | 1.79 | |
| Maunabo | 90 | 60 | 75.1 | 3.80 | |
| Mayaguez | 89 | 59 | 74.4 | 4.21 | |
| Morovis | 85 | 58 | 70.6 | 3.45 | |
| Ponce | 87 | 62 | 75.3 | 0.05 | |
| Rio Blanco | 86 | 60 | 75.2 | 5.11 | |
| Rio Piedras | ..... | ..... | ..... | 3.75 | |
| San German | 92 | 59 | 74.9 | 3.11 | |
| San Lorenzo | 89 | 55 | 71.8 | 2.47 | |
| San Salvador | 84 | 58 | 70.6 | 3.56 | |
| Santa Isabel | 88 | 63 | 75.2 | 00.8 | |
| Utuado | 90 | 53 | 72.8 | 5.41 | |
| Vieques | 87 | 62 | 74.0 | 1.49 | |
| Yauco | 84 | 58 | 73.6 | 1.63 | |
| *Mexico.* | | | | | |
| Ciudad P. Diaz | 72 | 14 | 42.8 | T. | |
| Coatzacoalcos | 87 | 49 | 69.4 | 3.80 | |
| Durango | 72 | 27 | 53.0 | 0.01 | |
| Leon de Aldamas | 74 | 33 | 57.3 | T. | |

TABLE II.—*Climatological record of voluntary and other cooperating observers. Late reports for November*—Continued.

| Stations. | Temperature. (Fahrenheit.) Maximum. | Minimum. | Mean. | Precipitation. Rain and melted snow. | Total depth of snow. |
|---|---|---|---|---|---|
| | ° | ° | ° | *Ins.* | *Ins.* |
| *Mexico*—Cont'd. | | | | | |
| Vera Cruz | 78 | 58 | 70.3 | 1.38 | |
| *New Brunswick.* | | | | | |
| St. John | 39 | —15 | 13.5 | 3.82 | 22.2 |
| *Isthmus of Panama.* | | | | | |
| Alhajuela | 93 | 72 | 82.1 | 2.99 | |
| Bohio | ..... | ..... | ..... | 6.89 | |
| Colon | ..... | ..... | ..... | 7.05 | |
| Gamboa | ..... | ..... | ..... | 3.35 | |
| La Boca | 86 | 71 | 78.3 | 2.60 | |
| *West Indies.* | | | | | |
| Columbia, Isle of Pines | 86 | 50 | 70.3 | 2.90 | |

*Late reports for December, 1903.*

| Stations. | Maximum. | Minimum. | Mean. | Rain and melted snow. | Total depth of snow. |
|---|---|---|---|---|---|
| *Alaska.* | | | | | |
| Copper Center | 39 | —19 | 6.0 | 0.75 | 14.5 |
| Fort Gibbon | 24 | —30 | 0.2 | ..... | ..... |
| Fort Liscum | 43 | 12 | 28.1 | 9.61 | 52.6 |
| Fort Yukon | 26 | —36 | —7.1 | 0.38 | 3.8 |
| Kenia | 40 | —10 | 20.0 | 0.18 | 1.5 |
| Wood Island | 45 | 24 | 35.2 | 8.29 | 5.0 |
| *California.* | | | | | |
| Durham | 59 | 30 | 44.8 | 2.90 | |
| San Miguel Island | 80 | 47 | 57.2 | 0.00 | |
| San Rafael | 64 | —32 | 48.6 | 2.42 | |
| *Delaware.* | | | | | |
| Delaware City | ..... | ..... | ..... | 4.23 | 6.2 |
| *Idaho.* | ° | ° | ° | *Ins.* | *Ins.* |
| Paris | 45[e] | —14[b] | 13.5[d] | ..... | ..... |
| Roosevelt | 47[j] | 2[j] | 24.3[j] | 0.91 | 18.0 |
| *Indiana.* | | | | | |
| Mount Vernon | 51 | 3 | 30.1 | 1.61 | ..... |
| *Iowa.* | | | | | |
| Olin | 44 | —22 | 18.3 | 1.09 | 8.0 |
| *Kansas.* | | | | | |
| Lawrence | 60 | 3 | 31.8 | 0.98 | 2.0 |
| *Montana.* | | | | | |
| Bozeman | 54 | 3 | 25.2 | 0.78 | 7.8 |
| Fort Harrison | 56 | 3 | 27.0 | ..... | |
| *New Jersey.* | | | | | |
| Ringwood | 50 | — 8 | 24.7 | 4.72 | 8.5 |
| *New Mexico.* | | | | | |
| Engle | 70 | 2 | 35.8 | 0.00 | |
| Los Lunas | 62 | 10 | 32.6 | 0.00 | |
| *North Dakota.* | | | | | |
| Wishek | 50 | —25 | 10.2 | 0.66 | 6.6 |
| *Ohio.* | | | | | |
| Norwalk | 44 | — 2 | 23.4 | 2.63 | 13.0 |
| *Texas.* | | | | | |
| Athens | 80 | 20 | 46.2 | 0.55 | |
| Marlin | 74 | 28 | 50.9 | 1.38 | |
| *Washington.* | | | | | |
| Colfax | 60 | 18 | 35.2 | 1.38 | |
| *Wisconsin.* | | | | | |
| Oconto | 36 | —18 | 14.7 | 0.93 | 8.5 |
| *Porto Rico.* | | | | | |
| La Carmelita | 85 | 62 | 73.6 | 5.17 | |

## EXPLANATION OF SIGNS.

*Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

1 Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
2 Mean of 8 a. m. + 8 p. m. ÷ 2.
3 Mean of 7 a. m. + 7 p. m. ÷ 2.
4 Mean of 6 a. m. + 6 p. m. ÷ 2.
5 Mean of 7 a. m. + 2 p. m. ÷ 2.
6 Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "n" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

## CORRECTIONS.

December, 1903, Pennsylvania, Girardville, make precipitation 4.83 instead of 4.93.

Quakertown, make total snowfall 15.5 instead of 1.4.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of January, 1904.*

| Stations. | Component direction from— | | | | Resultant. | |
|---|---|---|---|---|---|---|
| | N. | S. | E. | W. | Direction from— | Duration. |
| *New England.* | *Hours.* | *Hours.* | *Hours.* | *Hours.* | ° | *Hours.* |
| Eastport, Me | 27 | 6 | 11 | 32 | n. 45 w. | 30 |
| Portland, Me | 24 | 15 | 1 | 35 | n. 75 w. | 35 |
| Concord, N. H. † | 15 | 5 | 4 | 13 | n. 42 w. | 14 |
| Northfield, Vt | 20 | 35 | 6 | 11 | n. 18 w. | 16 |
| Boston, Mass | 25 | 12 | 8 | 29 | n. 59 w. | 25 |
| Nantucket, Mass | 22 | 10 | 11 | 30 | n. 58 w. | 22 |
| Block Island, R. I | 27 | 10 | 10 | 30 | n. 50 w. | 26 |
| Narragansett, R. I.* | 9 | 7 | 7 | 8 | n. 27 w. | 2 |
| New Haven, Conn | 35 | 9 | 11 | 22 | n. 23 w. | 28 |
| *Middle Atlantic States.* | | | | | | |
| Albany, N. Y | 27 | 17 | 9 | 19 | n. 45 w. | 14 |
| Binghamton, N. Y.† | 10 | 6 | 11 | 11 | n. | 4 |
| New York, N. Y | 25 | 11 | 11 | 30 | n. 54 w. | 24 |
| Harrisburg, Pa | 22 | 8 | 21 | 24 | n. 12 w. | 14 |
| Philadelphia, Pa | 27 | 11 | 18 | 23 | n. 17 w. | 17 |
| Scranton, Pa | 26 | 15 | 15 | 21 | n. 29 w. | 12 |
| Atlantic City, N. J | 29 | 10 | 10 | 26 | n. 40 w. | 25 |
| Cape May, N. J | 28 | 10 | 9 | 28 | n. 47 w. | 26 |
| Baltimore, Md | 26 | 9 | 17 | 22 | n. 16 w. | 18 |
| Washington, D. C | 31 | 13 | 13 | 19 | n. 18 w. | 19 |
| Cape Henry, Va.† | 13 | 11 | 4 | 10 | n. 72 w. | 6 |
| Lynchburg, Va | 20 | 16 | 15 | 27 | n. 72 w. | 13 |
| Norfolk, Va | 25 | 21 | 10 | 16 | n. 56 w. | 7 |
| Richmond, Va | 27 | 18 | 13 | 17 | n. 24 w. | 10 |
| Wytheville, Va | 10 | 10 | 15 | 38 | w. | 23 |
| *South Atlantic States.* | | | | | | |
| Asheville, N. C | 20 | 20 | 23 | 21 | e. | 2 |
| Charlotte, N. C | 13 | 25 | 17 | 23 | s. 27 w. | 13 |
| Hatteras, N. C | 32 | 12 | 12 | 20 | n. 22 w. | 22 |
| Kittyhawk, N. C. * | 13 | 7 | 9 | 12 | n. 27 w. | 7 |
| Raleigh, N. C | 23 | 16 | 12 | 25 | n. 62 w. | 15 |
| Wilmington, N. C | 25 | 16 | 11 | 33 | n. 68 w. | 24 |
| Charleston, S. C | 26 | 11 | 13 | 20 | n. 25 w. | 17 |
| Columbia, S. C | 12 | 22 | 17 | 21 | s. 22 w. | 11 |
| Augusta, Ga | 17 | 16 | 20 | 23 | n. 72 w. | 3 |
| Savannah, Ga | 29 | 12 | 10 | 20 | n. 30 w. | 20 |
| Jacksonville, Fla | 31 | 14 | 14 | 16 | n. 7 w. | 17 |
| *Florida Peninsula.* | | | | | | |
| Jupiter, Fla | 25 | 20 | 15 | 21 | n. 50 w. | 8 |
| Key West, Fla | 30 | 11 | 33 | 6 | n. 55 e. | 33 |
| Sand Key, Fla. † | 13 | 7 | 16 | 3 | n. 65 e. | 14 |
| Tampa, Fla | 30 | 10 | 18 | 16 | n. 6 e. | 20 |
| *Eastern Gulf States.* | | | | | | |
| Atlanta, Ga | 18 | 14 | 18 | 25 | n. 60 w. | 8 |
| Macon, Ga.† | 13 | 8 | 6 | 9 | n. 31 w. | 6 |
| Pensacola, Fla.† | 17 | 5 | 8 | 8 | n. | 12 |
| Birmingham, Ala.† | 7 | 13 | 8 | 11 | s. 27 w. | 7 |
| Mobile, Ala | 29 | 18 | 9 | 14 | n. 24 w. | 12 |
| Montgomery, Ala | 22 | 16 | 23 | 13 | n. 59 e. | 12 |
| Meridian, Miss.† | 9 | 9 | 7 | 11 | w. | 4 |
| Vicksburg, Miss | 18 | 23 | 19 | 16 | s. 31 e. | 6 |
| New Orleans, La | 25 | 18 | 20 | 16 | n. 30 e. | 8 |
| *Western Gulf States.* | | | | | | |
| Shreveport, La | 17 | 20 | 21 | 17 | s. 53 e. | 5 |
| Fort Smith, Ark | 15 | 14 | 25 | 21 | n. 76 e. | 4 |
| Little Rock, Ark | 20 | 18 | 19 | 21 | n. 45 w. | 3 |
| Corpus Christi, Tex | 25 | 17 | 20 | 9 | n. 54 e. | 14 |
| Fort Worth, Tex | 21 | 25 | 12 | 19 | s. 60 w. | 8 |
| Galveston, Tex | 23 | 16 | 22 | 13 | n. 52 e. | 11 |
| Palestine, Tex | 24 | 24 | 12 | 17 | w. | 5 |
| San Antonio, Tex | 25 | 18 | 18 | 16 | n. 16 e. | 7 |
| Taylor, Tex. † | 13 | 9 | 3 | 11 | n. 58 w. | 9 |
| *Ohio Valley and Tennessee.* | | | | | | |
| Chattanooga, Tenn | 15 | 24 | 14 | 21 | s. 38 w. | 11 |
| Knoxville, Tenn | 18 | 24 | 11 | 25 | s. 67 w. | 15 |
| Memphis, Tenn | 19 | 23 | 17 | 15 | s. 27 e. | 4 |
| Nashville, Tenn | 18 | 24 | 17 | 16 | s. 9 e. | 6 |
| Lexington, Ky. † | 3 | 14 | 10 | 8 | s. 10 e. | 11 |
| Louisville, Ky | 13 | 27 | 17 | 21 | s. 16 w. | 15 |
| Evansville, Ind.† | 11 | 11 | 6 | 10 | w. | 4 |
| Indianapolis, Ind | 23 | 16 | 15 | 24 | n. 52 w. | 11 |
| Cincinnati, Ohio | 8 | 18 | 22 | 24 | s. 11 w. | 10 |
| Columbus, Ohio | 14 | 27 | 18 | 18 | s. | 13 |
| Pittsburg, Pa | 22 | 21 | 13 | 23 | n. 84 w. | 10 |
| Parkersburg, W. Va | 16 | 23 | 8 | 24 | s. 66 w. | 18 |
| Elkins, W. Va | 15 | 16 | 2 | 37 | s. 88 w. | 35 |
| *Lower Lake Region.* | | | | | | |
| Buffalo, N. Y | 8 | 19 | 15 | 30 | s. 54 w. | 19 |
| Oswego, N. Y | 15 | 29 | 17 | 15 | s. 8 e. | 14 |
| Rochester, N. Y | 8 | 26 | 9 | 34 | s. 54 w. | 31 |
| Syracuse, N. Y | 11 | 23 | 19 | 20 | s. 5 w. | 12 |
| Erie, Pa | 17 | 17 | 14 | 25 | w. | 11 |
| Cleveland, Ohio | 10 | 30 | 19 | 18 | s. 3 e. | 20 |
| Sandusky, Ohio † | 5 | 15 | 4 | 14 | s. 45 w. | 14 |
| Toledo, Ohio | 14 | 21 | 11 | 27 | s. 66 w. | 18 |
| Detroit, Mich | 22 | 17 | 14 | 24 | n. 51 w. | 13 |
| *Upper Lake Region.* | | | | | | |
| Alpena, Mich | 19 | 13 | 10 | 33 | n. 75 w. | 24 |
| Escanaba, Mich | 24 | 15 | 9 | 28 | n. 65 w. | 21 |
| Grand Rapids, Mich | 18 | 17 | 18 | 19 | n. 45 w. | 1 |
| Houghton, Mich.† | 12 | 6 | 8 | 13 | n. 40 w. | 8 |
| Marquette, Mich | 13 | 17 | 3 | 40 | s. 84 w. | 37 |
| Port Huron, Mich | 18 | 13 | 12 | 31 | n. 75 w. | 20 |
| Sault Ste. Marie, Mich | 17 | 10 | 25 | 20 | n. 36 e. | 9 |
| Chicago, Ill | 24 | 14 | 11 | 27 | n. 58 w. | 19 |
| Milwaukee, Wis | 22 | 9 | 10 | 22 | n. 60 w. | 26 |
| Green Bay, Wis | 19 | 23 | 10 | 27 | s. 60 w. | 8 |
| Duluth, Minn | 23 | 14 | 10 | 33 | n. 69 w. | 25 |
| *North Dakota.* | | | | | | |
| Moorhead, Minn | 25 | 19 | 14 | 21 | n. 53 w. | 10 |
| Bismarck, N. Dak | 25 | 13 | 17 | 21 | n. 18 w. | 13 |
| *North Dakota*—Continued. | | | | | | |
| Williston, N. Dak | 9 | 21 | 18 | 25 | s. 30 w. | 14 |
| *Upper Mississippi Valley.* | | | | | | |
| Minneapolis, Minn.* | 9 | 9 | 7 | 13 | w. | 6 |
| St. Paul, Minn | 23 | 17 | 17 | 22 | n. 40 w. | 8 |
| La Crosse, Wis. † | 13 | 13 | 3 | 6 | w. | 3 |
| Davenport, Iowa | 25 | 9 | 21 | 25 | n. 14 w. | 16 |
| Des Moines, Iowa | 26 | 13 | 21 | 19 | n. 9 e. | 13 |
| Dubuque, Iowa | 27 | 11 | 15 | 27 | n. 37 w. | 20 |
| Keokuk, Iowa | 24 | 14 | 18 | 21 | n. 17 w. | 10 |
| Cairo, Ill | 22 | 24 | 15 | 18 | s. 56 w. | 4 |
| Springfield, Ill | 17 | 16 | 19 | 22 | n. 72 w. | 3 |
| Hannibal, Mo. † | 12 | 5 | 8 | 12 | n. 30 w. | 8 |
| St. Louis, Mo | 21 | 21 | 17 | 19 | w. | 2 |
| *Missouri Valley.* | | | | | | |
| Columbia, Mo. * | 12 | 6 | 9 | 9 | n. | 6 |
| Kansas City, Mo | 22 | 21 | 15 | 20 | n. 79 w. | 5 |
| Springfield, Mo | 23 | 21 | 13 | 22 | n. 77 w. | 9 |
| Topeka, Kans.* | 12 | 9 | 5 | 8 | n. 45 w. | 4 |
| Lincoln, Nebr | 27 | 20 | 15 | 12 | n. 23 e. | 8 |
| Omaha, Nebr | 28 | 20 | 14 | 14 | n. | 8 |
| Valentine, Nebr | 32 | 7 | 7 | 26 | n. 37 w. | 31 |
| Sioux City, Iowa † | 13 | 10 | 7 | 13 | n. 63 w. | 7 |
| Pierre, S. Dak | 18 | 9 | 30 | 17 | n. 55 e. | 16 |
| Huron, S. Dak | 25 | 17 | 22 | 17 | n. 32 e. | 9 |
| Yankton, S. Dak. † | 11 | 3 | 10 | 12 | n. 14 w. | 8 |
| *Northern Slope.* | | | | | | |
| Havre, Mont | 22 | 17 | 13 | 32 | n. 75 w. | 20 |
| Miles City, Mont | 23 | 23 | 12 | 20 | w. | 8 |
| Helena, Mont | 8 | 27 | 3 | 43 | s. 65 w. | 44 |
| Kalispell, Mont | 3 | 19 | 11 | 37 | s. 58 w. | 30 |
| Rapid City, S. Dak | 27 | 6 | 11 | 31 | n. 44 w. | 29 |
| Cheyenne, Wyo | 28 | 9 | 0 | 40 | n. 65 w. | 44 |
| Lander, Wyo | 14 | 29 | 12 | 27 | s. 45 w. | 21 |
| Yellowstone Park, Wyo | 6 | 37 | 5 | 28 | s. 36 w. | 39 |
| North Platte, Nebr | 20 | 14 | 8 | 34 | n. 77 w. | 27 |
| *Middle Slope.* | | | | | | |
| Denver, Colo | 15 | 21 | 12 | 25 | n. 39 w. | 21 |
| Pueblo, Colo | 22 | 11 | 20 | 17 | n. 15 e. | 11 |
| Concordia, Kans | 24 | 19 | 17 | 15 | n. 22 e. | 5 |
| Dodge, Kans | 24 | 11 | 10 | 27 | n. 52 w. | 22 |
| Wichita, Kans | 26 | 24 | 11 | 11 | n. | 2 |
| Oklahoma, Okla | 22 | 25 | 10 | 16 | s. 63 w. | 7 |
| *Southern Slope.* | | | | | | |
| Abilene, Tex | 20 | 28 | 9 | 18 | s. 48 w. | 12 |
| Amarillo, Tex | 21 | 22 | 6 | 25 | s. 87 w. | 19 |
| *Southern Plateau.* | | | | | | |
| El Paso, Tex | 20 | 9 | 13 | 34 | n. 62 w. | 24 |
| Santa Fe, N. Mex | 31 | 10 | 21 | 16 | n. 13 e. | 22 |
| Flagstaff, Ariz | 23 | 14 | 15 | 23 | n. 42 w. | 12 |
| Phoenix. Ariz | 13 | 13 | 25 | 21 | e. | 4 |
| Yuma, Ariz | 35 | 4 | 9 | 10 | n. 2 w. | 31 |
| Independence, Cal | 27 | 13 | 10 | 31 | n. 56 w. | 25 |
| *Middle Plateau.* | | | | | | |
| Carson City, Nev | 15 | 20 | 14 | 22 | s. 58 w. | 9 |
| Winnemucca, Nev | 15 | 25 | 13 | 24 | s. 66 w. | 12 |
| Modena, Utah | 11 | 10 | 21 | 30 | n. 84 w. | 9 |
| Salt Lake City, Utah | 17 | 27 | 22 | 15 | s. 35 e. | 12 |
| Grand Junction, Colo | 19 | 19 | 23 | 18 | e. | 5 |
| *Northern Plateau.* | | | | | | |
| Baker City, Oreg | 13 | 31 | 20 | 19 | s. 3 e. | 18 |
| Boise, Idaho | 17 | 24 | 15 | 21 | s. 66 w. | 18 |
| Lewiston, Idaho † | 2 | 7 | 13 | 14 | s. 11 w. | 5 |
| Pocatello, Idaho | 2 | 19 | 34 | 16 | s. 47 e. | 25 |
| Spokane, Wash | 2 | 39 | 15 | 15 | s. | 37 |
| Walla Walla, Wash | 4 | 41 | 10 | 15 | s. 8 w. | 37 |
| *North Pacific Coast Region.* | | | | | | |
| North Head, Wash | 15 | 23 | 20 | 21 | s. 7 w. | 8 |
| Port Crescent, Wash* | 5 | 14 | 13 | 9 | s. 24 e. | 10 |
| Seattle, Wash | 11 | 31 | 27 | 8 | s. 44 e. | 28 |
| Tacoma, Wash | 8 | 37 | 7 | 30 | s. 38 w. | 37 |
| Tatoosh Island, Wash | 9 | 25 | 23 | 19 | s. 14 e. | 16 |
| Portland, Oreg | 12 | 24 | 12 | 30 | s. 56 w. | 22 |
| Roseburg, Oreg | 17 | 23 | 26 | 15 | s. 61 e. | 12 |
| *Middle Pacific Coast Region.* | | | | | | |
| Eureka, Cal | 19 | 26 | 18 | 15 | s. 23 e. | 8 |
| Mount Tamalpais, Cal | 43 | 3 | 8 | 21 | n. 18 w. | 42 |
| Red Bluff, Cal | 41 | 8 | 10 | 10 | n. | 33 |
| Sacramento, Cal | 24 | 19 | 28 | 5 | n. 78 e. | 24 |
| San Francisco, Cal | 31 | 9 | 8 | 26 | n. 39 w. | 28 |
| Point Reyes Light, Cal* | 22 | 2 | 0 | 17 | n. 40 w. | 26 |
| Southeast Farallon, Cal* | 21 | 2 | 0 | 17 | n. 42 w. | 26 |
| *South Pacific Coast Region.* | | | | | | |
| Fresno, Cal | 30 | 11 | 16 | 17 | n. 3 w. | 19 |
| Los Angeles, Cal | 22 | 11 | 17 | 25 | n. 36 w. | 14 |
| San Diego, Cal | 35 | 5 | 21 | 21 | n. | 30 |
| San Luis Obispo, Cal | 42 | 9 | 3 | 13 | n. 17 w. | 34 |
| *West Indies* | | | | | | |
| Basseterre, St. Kitts, W. I | ...... | ...... | ...... | ...... | ...... | ...... |
| Bridgetown, Barbados | ...... | ...... | ...... | ...... | ...... | ...... |
| Cienfuegos, Cuba | ...... | ...... | ...... | ...... | ...... | ...... |
| Colon, Colombia, S. A. † | ...... | ...... | ...... | ...... | ...... | ...... |
| Curaçoa, W. I | ...... | ...... | ...... | ...... | ...... | ...... |
| Grand Turk, W. I. † | ...... | ...... | ...... | ...... | ...... | ...... |
| Hamilton, Bermuda | 19 | 23 | 9 | 29 | s. 79 w. | 20 |
| Havana, Cuba† | 6 | 4 | 21 | 3 | n. 84 e. | 18 |
| Kingston, Jamaica | ...... | ...... | ...... | ...... | ...... | ...... |
| Port of Spain, Trinidad † | ...... | ...... | ...... | ...... | ...... | ...... |
| Puerto Principe, Cuba | ...... | ...... | ...... | ...... | ...... | ...... |
| Roseau, Dominica, W. I. † | ...... | ...... | ...... | ...... | ...... | ...... |
| San Juan, Porto Rico | 4 | 32 | 39 | 4 | s. 28 e. | 32 |
| Santiago de Cuba, Cuba | ...... | ...... | ...... | ...... | ...... | ...... |

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Thunderstorms and auroras, January, 1904.*

| States. | No. of stations. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Total. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | No. | Days. | |
| Alabama | 52 | T. | | 3 | | | | | | | | | | 2 | | | | 7 | | | | | 5 | 7 | | | | | | | | | | 24 | 5 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Arizona | 56 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | 1 | | | | | | | | | | | | | | | | | | 1 | | 1 | 1 | | | | | | | | | 4 | 4 | A. |
| Arkansas | 57 | T. | | | | | | | | | 1 | | | | | | | 1 | | | | 3 | 12 | | | | | 1 | | | | 1 | 2 | 21 | 7 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| California | 167 | T. | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | 2 | 2 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Colorado | 81 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Connecticut | 21 | T. | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | 3 | 1 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Delaware | 5 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Dist. of Columbia | 4 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Florida | 47 | T. | | 1 | | | | | | | | 2 | 1 | 5 | 9 | | | 1 | | | | | 2 | 5 | 2 | | 1 | | | 8 | 2 | | | 39 | 12 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Georgia | 55 | T. | | 1 | | | | | | | | 2 | 1 | 1 | | | | 1 | | | | | | 16 | | | | | | 1 | | | | 23 | 7 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Idaho | 34 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | | | 2 | 2 | A. |
| Illinois | 92 | T. | | | | | | | | | | 2 | | | | | | | | | | 4 | | | | | | | | | | | | 6 | 2 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Indiana | 58 | T. | 1 | | | | | | | | | 1 | | | | | | | | | | 1 | 2 | 1 | | | | | | | | | | 6 | 5 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Indian Territory | 11 | T. | | | | | | | | | | | | | | | | | | | | 4 | 6 | | | | | | | | | | | 10 | 2 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Iowa | 149 | T. | | | | | | | | | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | 2 | 2 | T. |
| | | A. | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | A. |
| Kansas | 77 | T. | | | | | | | | 1 | 5 | 1 | | | | | | | | | 3 | 6 | 1 | | | | | | | | | | | 17 | 6 | T. |
| | | A. | 1 | | 1 | | | | | | | | | | | | | | 1 | | | | | | | 1 | 1 | | | | | | | 5 | 5 | A. |
| Kentucky | 41 | T. | | | | | | | | | | 4 | 2 | | | | | | | | | | | 2 | | | | | | | | | | 8 | 3 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Louisiana | 46 | T. | 1 | 1 | | | | 1 | 1 | | 1 | | | | | | | | | | | | 9 | 3 | | | | | | 1 | | | | 18 | 8 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Maine | 19 | T. | | | | | | | | | | | | | 1 | 2 | | | | | | | | | | | | | | | | | | 3 | 2 | T. |
| | | A. | | | | | | | | | | | 2 | | | | 3 | | | | | | | | | | 1 | | | | | | | 6 | 3 | A. |
| Maryland | 48 | T. | | | | | | | | | | | | | | | | | | | | | | 3 | | | | 1 | | | | | | 4 | 2 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Massachusetts | 48 | T. | | | | | | | | | | | | | 15 | | | | | | | | | 1 | | | | | | | | | | 16 | 2 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Michigan | 106 | T. | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | 1 | 4 | 4 | T. |
| | | A. | 1 | | | 1 | 1 | | | | | | | 1 | 1 | | 1 | | | | | | | | | | | | | | | | | 6 | 6 | A. |
| Minnesota | 67 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Mississippi | 44 | T. | | | | | | 3 | | | 3 | | | | | | 1 | 7 | | | | | 8 | 2 | 1 | | | | 1 | | | | 1 | 27 | 9 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Missouri | 95 | T. | | 1 | | | | | | | 11 | 3 | | | | | | | | | 1 | 12 | 6 | 1 | | | | | | | | | | 35 | 2 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Montana | 40 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | 3 | 1 | A. |
| Nebraska | 142 | T. | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | 2 | 2 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Nevada | 40 | T. | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| New Hampshire | 19 | T. | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | 1 | 1 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| New Jersey | 51 | T. | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 | 1 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| New Mexico | 31 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| New York | 99 | T. | | | | | | | | | | | | | 1 | | | | | | | | 1 | 2 | | | | | | | | | | 4 | 3 | T. |
| | | A. | | | | | | | | | | | 1 | | | | | | | | | 1 | | 1 | | | 1 | | | 1 | | 1 | | 6 | 6 | A. |
| North Carolina | 56 | T. | | 1 | | | | | | | | 1 | 7 | | | | | | | | | | | 2 | 1 | | | | | | | | | 12 | 5 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| North Dakota | 48 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | 1 | 1 | | | | 1 | 1 | 1 | 1 | | | | | | | 2 | 2 | | | | | | | | 10 | 8 | A. |
| Ohio | 128 | T. | | | | | | | | | | | | | | | | | | | | 1 | 1 | 10 | 1 | | | | | | | | | 13 | 4 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Oklahoma | 23 | T. | | | | | | | | | | | | | | | | | | | | 6 | 3 | 1 | | | | | | | | | | 10 | 3 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Oregon | 74 | T. | | | | | | | | | | 5 | | | | | | | | | | | | 1 | | | | | | | | | | 6 | 2 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Pennsylvania | 91 | T. | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | 2 | 1 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Rhode Island | 7 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| South Carolina | 46 | T. | | | | | | | | | | 6 | 6 | | | | | 1 | | | | | | 14 | 1 | | | | | | | | | 28 | 5 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| South Dakota | 56 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | 1 | 1 | 1 | | | | | | 1 | | | | | | | 2 | 1 | 1 | | 1 | 1 | 1 | | 1 | 12 | 11 | A. |
| Tennessee | 56 | T. | 1 | | | | | | | | | 2 | 4 | | | | | 3 | | | | | 6 | 11 | 1 | | | | | | | | | 28 | 7 | T. |
| | | A. | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | A. |
| Texas | 95 | T. | 4 | | | | | 4 | 1 | | | 1 | | | | | | | | | | 8 | 16 | 1 | | | | | 2 | | | 2 | | 39 | 9 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Utah | 47 | T. | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | 2 | 1 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Vermont | 16 | T. | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | 1 | 1 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Virginia | 50 | T. | | 1 | 1 | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | 4 | 3 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Washington | 64 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| West Virginia | 43 | T. | | | | | | | | | | | | 1 | | | | | | | | | | 4 | | | | | | | | | | 5 | 2 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Wisconsin | 60 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Wyoming | 31 | T. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | T. |
| | | A. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | A. |
| Sums | 2833 | T. | 7 | 9 | 1 | 0 | 0 | 8 | 2 | 1 | 21 | 33 | 23 | 10 | 30 | 2 | 1 | 22 | 1 | 1 | 6 | 48 | 79 | 90 | 7 | 0 | 1 | 2 | 3 | 10 | 2 | 3 | 4 | 427 | .... | T. |
| | | A. | 2 | 1 | 2 | 1 | 1 | 0 | 0 | 2 | 6 | 1 | 3 | 2 | 3 | 1 | 5 | 2 | 1 | 0 | 0 | 2 | 0 | 2 | 5 | 4 | 4 | 0 | 1 | 2 | 1 | 1 | 1 | 56 | .... | A. |

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during January, 1904, at all stations furnished with self-registering gages.*

| Stations. | Date. | Total duration. From— | Total duration. To— | Total amount of precipitation. | Excessive rate. Began— | Excessive rate. Ended— | Amount before excessive began. | Depths of precipitation (in inches) during periods of time indicated. 5 min. | 10 min. | 15 min. | 20 min. | 25 min. | 30 min. | 35 min. | 40 min. | 45 min. | 50 min. | 60 min. | 80 min. | 100 min. | 120 min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | | | | | | | | | | | | |
| Albany, N. Y | 21–22 | | | 1.03 | | | | | | | | | | | | | | * | | | |
| Alpena, Mich | 21–22 | | | 0.46 | | | | | | | | | | | | | | * | | | |
| Amarillo, Tex | 11 | | | 0.15 | | | | | | | | | | | | | | * | | | |
| Asheville, N. C | 21–22 | | | 0.38 | | | | | | | | | | | | | | 0.12 | | | |
| Atlanta, Ga | 22 | | | 1.14 | | | | | | | | | | | | | | 0.49 | | | |
| Atlantic City, N. J | 13 | | | 0.34 | | | | | | | | | | | | | | 0.17 | | | |
| Augusta, Ga | 22 | | | 1.36 | | | | | | | | | | | | | | 0.68 | | | |
| Baltimore, Md | 13 | | | 0.32 | | | | | | | | | | | | | | 0.24 | | | |
| Binghamton, N. Y | 20–22 | | | 0.97 | | | | | | | | | | | | | | * | | | |
| Birmingham, Ala | 9–10 | | | 0.55 | | | | | | | | | | | | | | 0.32 | | | |
| Bismarck, N. Dak | 29–30 | | | 0.19 | | | | | | | | | | | | | | * | | | |
| Block Island, R. I | 2–3 | | | 0.73 | | | | | | | | | | | | | | * | | | |
| Boise, Idaho | 4 | | | 0.25 | | | | | | | | | | | | | | * | | | |
| Boston, Mass | 26 | | | 0.73 | | | | | | | | | | | | | | 0.31 | | | |
| Buffalo, N. Y | 13–15 | | | 1.79 | | | | | | | | | | | | | | * | | | |
| Cairo, Ill | 21–22 | | | 2.70 | | | | | | | | | | | | | | 0.40 | | | |
| Charleston, S. C | 22–23 | | | 2.14 | | | | | | | | | | | | | | 0.48 | | | |
| Charlotte, N. C | 22 | | | 0.84 | | | | | | | | | | | | | | 0.36 | | | |
| Chattanooga, Tenn | 21–22 | | | 1.14 | | | | | | | | | | | | | | 0.30 | | | |
| Chicago, Ill | 19–21 | | | 1.25 | | | | | | | | | | | | | | * | | | |
| Cincinnati, Ohio | 21–22 | | | 1.21 | | | | | | | | | | | | | | 0.25 | | | |
| Cleveland, Ohio | 20–22 | | | 2.48 | | | | | | | | | | | | | | 0.15 | | | |
| Columbia, Mo | 20–21 | | | 0.86 | | | | | | | | | | | | | | 0.21 | | | |
| Columbia, S. C | 22 | | | 0.81 | | | | | | | | | | | | | | 0.51 | | | |
| Columbus, Ohio | 20–22 | | | 1.40 | | | | | | | | | | | | | | 0.20 | | | |
| Concord, N. H | 21–22 | | | 1.01 | | | | | | | | | | | | | | * | | | |
| Corpus Christi, Tex | 27–28 | | | 0.08 | | | | | | | | | | | | | | 0.02 | | | |
| Davenport, Iowa | 19–21 | | | 1.88 | | | | | | | | | | | | | | * | | | |
| Denver, Colo | 27–28 | | | 0.02 | | | | | | | | | | | | | | | | | |
| Des Moines, Iowa | 19–21 | | | 0.98 | | | | | | | | | | | | | | * | | | |
| Detroit, Mich | 20–22 | | | 1.93 | | | | | | | | | | | | | | 0.11 | | | |
| Dodge, Kans | 1 | | | 0.02 | | | | | | | | | | | | | | | | | |
| Dubuque, Iowa | 20 | | | 0.30 | | | | | | | | | | | | | | * | | | |
| Duluth, Minn | 11–12 | | | 0.11 | | | | | | | | | | | | | | * | | | |
| Eastport, Me | 14 | | | 0.25 | | | | | | | | | | | | | | 0.09 | | | |
| Elkins, W. Va | 22 | | | 0.24 | | | | | | | | | | | | | | 0.19 | | | |
| Erie, Pa | 20–22 | | | 2.79 | | | | | | | | | | | | | | * | | | |
| Escanaba, Mich | 23–24 | | | 0.13 | | | | | | | | | | | | | | * | | | |
| Evansville, Ind | 21–22 | | | 2.55 | | | | | | | | | | | | | | 0.34 | | | |
| Fort Smith, Ark | 21 | | | 2.79 | | | | | | | | | | | | | | 0.47 | | | |
| Fort Worth, Tex | 21 | | | 0.97 | | | | | | | | | | | | | | 0.32 | | | |
| Galveston, Tex | 6 | | | 0.37 | | | | | | | | | | | | | | 0.37 | | | |
| Grand Junction, Colo | 22 | | | 0.18 | | | | | | | | | | | | | | * | | | |
| Grand Rapids, Mich | 20–22 | | | 0.61 | | | | | | | | | | | | | | * | | | |
| Green Bay, Wis | 7 | | | 0.20 | | | | | | | | | | | | | | * | | | |
| Harrisburg, Pa | 21–22 | | | 0.75 | | | | | | | | | | | | | | 0.16 | | | |
| Hatteras, N. C | 28 | | | 1.24 | | | | | | | | | | | | | | 0.72 | | | |
| Huron, S. Dak | 1 | | | 0.09 | | | | | | | | | | | | | | * | | | |
| Indianapolis, Ind | 20–22 | | | 2.56 | | | | | | | | | | | | | | * | | | |
| Jacksonville, Fla | 22–23 | | | 2.33 | | | | | | | | | | | | | | 0.53 | | | |
| Jupiter, Fla | 23–24 | | | 0.93 | | | | | | | | | | | | | | 0.44 | | | |
| Kalispell, Mont | 12 | | | 0.27 | | | | | | | | | | | | | | * | | | |
| Kansas City, Mo | 20 | | | 0.30 | | | | | | | | | | | | | | 0.13 | | | |
| Key West, Fla | 23 | | | 0.77 | | | | | | | | | | | | | | 0.51 | | | |
| Knoxville, Tenn | 22 | | | 0.74 | | | | | | | | | | | | | | 0.26 | | | |
| La Crosse, Wis | 21 | | | 0.16 | | | | | | | | | | | | | | * | | | |
| Lewiston, Idaho | 14 | | | 0.13 | | | | | | | | | | | | | | 0.10 | | | |
| Lexington, Ky | 21–22 | | | 0.71 | | | | | | | | | | | | | | * | | | |
| Lincoln, Nebr | 9–10 | | | 0.17 | | | | | | | | | | | | | | * | | | |
| Little Rock, Ark | 21–22 | | | 2.04 | | | | | | | | | | | | | | 0.30 | | | |
| Los Angeles, Cal | 17–18 | | | 0.14 | | | | | | | | | | | | | | 0.13 | | | |
| Louisville, Ky | 21–22 | | | 1.25 | | | | | | | | | | | | | | 0.32 | | | |
| Lynchburg, Va | 28 | | | 0.58 | | | | | | | | | | | | | | * | | | |
| Macon, Ga | 22 | | | 1.26 | | | | | | | | | | | | | | 0.71 | | | |
| Memphis, Tenn | 21–22 | | | 2.03 | | | | | | | | | | | | | | 0.56 | | | |
| Meridian, Miss | 21 | 5:00 p. m. | 9:00 p. m. | 1.10 | 7:00 p. m. | 7:15 p. m. | 0.47 | 0.09 | 0.25 | 0.55 | 0.57 | | | | | | | | | | |
| Milwaukee, Wis | 20–21 | | | 0.72 | | | | | | | | | | | | | | * | | | |
| Montgomery, Ala | 16 | | | 1.10 | | | | | | | | | | | | | | 0.52 | | | |
| Nantucket, Mass | 26–27 | | | 0.49 | | | | | | | | | | | | | | 0.31 | | | |
| Nashville, Tenn | 21–22 | 8:05 p. m. | 3:15 a. m. | 1.80 | 12:13 a. m. | 12:53 a. m. | 0.20 | 0.13 | 0.28 | 0.48 | 0.64 | 0.79 | 0.93 | 1.04 | 1.16 | | | | | | |
| New Haven, Conn | 2–3 | | | 0.76 | | | | | | | | | | | | | | * | | | |
| New Orleans, La | 22 | | | 0.47 | | | | | | | | | | | | | | 0.47 | | | |
| New York, N. Y | 26 | | | 0.82 | | | | | | | | | | | | | | 0.29 | | | |
| Norfolk, Va | 22–23 | | | 1.22 | | | | | | | | | | | | | | 0.41 | | | |
| Northfield, Vt | 26–27 | | | 0.62 | | | | | | | | | | | | | | * | | | |
| North Head, Wash | 13–14 | | | 0.54 | | | | | | | | | | | | | | 0.16 | | | |
| Oklahoma, Okla | 20–21 | | | 2.02 | | | | | | | | | | | | | | 0.56 | | | |
| Omaha, Nebr | 27–28 | | | 0.09 | | | | | | | | | | | | | | 0.06 | | | |
| Palestine, Tex | 9 | | | 0.21 | | | | | | | | | | | | | | 0.20 | | | |
| Parkersburg, W. Va | 22 | | | 0.22 | | | | | | | | | | | | | | 0.16 | | | |
| Pensacola, Fla | 22 | 5:15 a. m. | 9:03 a. m. | 0.86 | 5:52 a. m. | 6:14 a. m. | 0.04 | 0.05 | 0.09 | 0.26 | 0.44 | 0.53 | | | | | | | | | |
| Philadelphia, Pa | 26 | | | 0.45 | | | | | | | | | | | | | | 0.18 | | | |
| Pittsburg, Pa | 20–21 | | | 0.75 | | | | | | | | | | | | | | * | | | |
| Pocatello, Idaho | 10–11 | | | 0.48 | | | | | | | | | | | | | | * | | | |
| Portland, Me | 13 | | | 1.15 | | | | | | | | | | | | | | 0.31 | | | |
| Portland, Oreg | 9–10 | | | 0.39 | | | | | | | | | | | | | | 0.23 | | | |
| Pueblo, Colo | 25 | | | 0.12 | | | | | | | | | | | | | | * | | | |
| Raleigh, N. C | 22–23 | | | 1.26 | | | | | | | | | | | | | | * | | | |
| Richmond, Va | 22 | | | 0.41 | | | | | | | | | | | | | | 0.15 | | | |
| Rochester, N. Y | 20–22 | | | 1.47 | | | | | | | | | | | | | | * | | | |
| Sacramento, Cal | 17 | | | 0.22 | | | | | | | | | | | | | | 0.09 | | | |
| St. Louis, Mo | 20–21 | | | 1.71 | | | | | | | | | | | | | | 0.44 | | | |
| St. Paul, Minn | 21 | | | 0.27 | | | | | | | | | | | | | | 0.06 | | | |
| Salt Lake City, Utah | 19–20 | | | 0.55 | | | | | | | | | | | | | | * | | | |
| San Antonio, Tex | 1 | | | 0.30 | | | | | | | | | | | | | | 0.23 | | | |
| San Diego, Cal | 19 | | | 0.03 | | | | | | | | | | | | | | 0.03 | | | |
| Sandusky, Ohio | 20–22 | | | 2.89 | | | | | | | | | | | | | | * | | | |
| San Francisco, Cal | 17 | | | 0.59 | | | | | | | | | | | | | | 0.31 | | | |
| Savannah, Ga | 22–23 | | | 2.15 | | | | | | | | | | | | | | 0.54 | | | |
| Scranton, Pa | 21–22 | | | 1.17 | | | | | | | | | | | | | | 0.25 | | | |
| Seattle, Wash | 15–16 | | | 0.73 | | | | | | | | | | | | | | 0.18 | | | |

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

| Stations. | Date. | Total duration. From— | Total duration. To— | Total amount of precipitation. | Excessive rate. Began— | Excessive rate. Ended— | Amount before excessive began. | 5 min. | 10 min. | 15 min. | 20 min. | 25 min. | 30 min. | 35 min. | 40 min. | 45 min. | 50 min. | 60 min. | 80 min. | 100 min. | 120 min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | | | | | | | | | | | | |
| Shreveport, La | 21 | | | 0.76 | | | | | | | | | | | | | | 0.52 | | | |
| Spokane, Wash | 9-10 | | | 0.40 | | | | | | | | | | | | | | * | | | |
| Springfield, Ill | 20-21 | | | 0.69 | | | | | | | | | | | | | | * | | | |
| Syracuse, N. Y | 20-22 | | | 2.09 | | | | | | | | | | | | | | * | | | |
| Tampa, Fla | 13 | 2:25 a.m. | 5:30 a.m. | 1.57 | 2:45 a.m. | 4:13 a.m. | 0.01 | 0.09 | 0.12 | 0.12 | 0.13 | 0.17 | 0.22 | 0.35 | 0.52 | 0.62 | 0.75 | 0.79 | 1.14 | 1.48 | |
| Do | 23 | 5:50 a.m. | 8:20 p.m. | 3.23 | 7:25 a.m. | 8:15 a.m. | 0.51 | 0.07 | 0.11 | 0.18 | 0.30 | 0.34 | 0.35 | 0.35 | 0.40 | 0.40 | 0.43 | | | | |
| | | | | | 8:15 a.m. | 9:05 a.m. | | 0.51 | 0.56 | 0.64 | 0.76 | 0.78 | 0.81 | 0.93 | 1.06 | 1.13 | 1.16 | | | | |
| | | | | | 9:05 a.m. | 10:30 a.m. | | 1.22 | 1.28 | 1.36 | 1.46 | 1.53 | 1.59 | 1.65 | 1.69 | 1.74 | 1.78 | 1.87 | 2.11 | | |
| Taylor, Tex | 1 | | | 0.03 | | | | | | | | | | | | | | | | | |
| Toledo, Ohio | 20-22 | | | 2.43 | | | | | | | | | | | | | | * | | | |
| Topeka, Kans | 19-20 | | | 0.52 | | | | | | | | | | | | | | * | | | |
| Valentine, Nebr | 28-29 | | | 0.24 | | | | | | | | | | | | | | * | | | |
| Vicksburg, Miss | 21 | 7:19 p.m. | 11:00 p.m. | 0.78 | 10:25 p.m. | 10:55 p.m. | 0.09 | 0.16 | 0.45 | 0.50 | 0.54 | 0.61 | 0.67 | | | | | | | | |
| Washington, D. C | 11 | | | 0.53 | | | | | | | | | | | | | | 0.12 | | | |
| Wichita, Kans | 20 | | | 0.08 | | | | | | | | | | | | | | * | | | |
| Wilmington, N. C | 22-23 | | | 1.27 | | | | | | | | | | | | | | 0.22 | | | |
| Wytheville, Va | 28-29 | | | 0.42 | | | | | | | | | | | | | | * | | | |
| Yankton, S. Dak | 26-27 | | | 0.06 | | | | | | | | | | | | | | * | | | |
| Havana, Cuba | 24-25 | | | 1.37 | | | | | | | | | | | | | | 0.44 | | | |
| San Juan, Porto Rico | 16 | | | 0.73 | | | | | | | | | | | | | | 0.30 | | | |

* Self register not working. † No precipitation during the month.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, January, 1904.*

| Stations. | Pressure, in inches. Actual, reduced to mean of 24 hours. | Sea level, reduced to mean of 24 hours. | Departure from normal. | Temperature. Mean. | Departure from normal. | Mean maximum. | Mean minimum. | Precipitation. Total. | Departure from normal. | Depth of snow. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Ins. | Ins. | Ins. | ° | ° | ° | ° | Ins. | Ins. | Ins. |
| St. Johns, N. F | 29.63 | 29.77 | −.09 | 21.8 | − 2.0 | 28.9 | 14.6 | 2.87 | −3.04 | 16.5 |
| Sydney, C. B. I | 29.92 | 29.96 | +.03 | 17.3 | − 3.2 | 25.5 | 9.1 | 6.48 | +1.38 | 44.0 |
| Halifax, N. S | 29.88 | 29.99 | +.02 | 20.0 | − 1.8 | 27.8 | 12.3 | 5.92 | +0.15 | 23.7 |
| Grand Manan, N. B | 29.93 | 29.99 | .00 | 18.9 | − 4.5 | 25.6 | 12.1 | 3.63 | −1.28 | 30.3 |
| Yarmouth, N. S | 29.93 | 30.01 | +.01 | 22.7 | − 3.6 | 29.4 | 15.9 | 5.51 | +0.10 | 29.5 |
| Charlottetown, P. E. I | 29.93 | 29.97 | +.01 | 12.5 | − 4.5 | 20.9 | 4.0 | 3.05 | −0.91 | 24.2 |
| Chatham, N. B | 29.96 | 29.99 | +.02 | 6.5 | − 3.3 | 16.8 | − 3.8 | 2.90 | −0.69 | 27.7 |
| Father Point, Que | 29.99 | 30.02 | +.04 | 6.0 | − 2.0 | 14.2 | − 2.1 | 2.07 | −0.78 | 20.7 |
| Quebec, Que | 29.71 | 30.05 | +.03 | 6.1 | − 3.0 | 12.9 | − 0.8 | 3.27 | −0.74 | 32.7 |
| Montreal, Que | 29.85 | 30.08 | +.04 | 7.4 | − 4.3 | 14.8 | 0.1 | 3.82 | +0.09 | 38.2 |
| Bissett, Ont | 29.44 | 30.09 | +.07 | −1.6 | − 8.0 | 11.9 | −15.1 | 1.80 | −0.52 | 18.0 |
| Ottawa, Ont | 29.72 | 30.06 | +.03 | 4.9 | − 4.7 | 12.6 | − 2.8 | 3.82 | +0.83 | 38.2 |
| Kingston, Ont | 29.73 | 30.07 | +.02 | 10.2 | − 6.9 | 20.4 | 0.0 | 2.15 | −1.30 | 20.7 |
| Toronto, Ont | 29.67 | 30.07 | +.02 | 16.0 | − 5.4 | 24.4 | 7.6 | 2.41 | −0.51 | 18.9 |
| White River, Ont | 28.65 | 30.06 | +.05 | −4.7 | − 4.3 | 9.4 | −18.8 | 1.51 | −0.18 | 13.1 |
| Port Stanley, Ont | 29.40 | 30.07 | .00 | 16.5 | − 5.7 | 24.8 | 8.3 | 4.33 | +1.34 | 31.8 |
| Saugeen, Ont | 29.31 | 30.06 | +.03 | 14.4 | − 6.0 | 23.9 | 4.8 | 3.95 | −0.10 | 38.9 |
| Parry Sound, Ont | 29.27 | 30.01 | .00 | 7.3 | − 6.5 | 18.5 | − 3.9 | 3.30 | −0.78 | 33.0 |
| Port Arthur, Ont | 29.34 | 30.09 | +.02 | 4.4 | + 1.3 | 15.2 | − 6.3 | 0.23 | −0.59 | 2.3 |
| Winnipeg, Man | 29.22 | 30.12 | +.01 | −3.0 | + 3.8 | 7.4 | −13.4 | 0.17 | −0.71 | 1.7 |
| Minnedosa, Man | 28.15 | 30.09 | −.01 | −0.2 | + 7.0 | 11.4 | −12.0 | 1.35 | +0.55 | 13.5 |
| Qu'Appelle, Assin | 27.64 | 30.02 | −.06 | 2.1 | + 5.9 | 11.6 | − 7.4 | 1.14 | +0.64 | 11.4 |
| Medicine Hat, Assin | 27.62 | 29.99 | −.08 | 18.3 | +12.8 | 28.2 | 8.4 | 0.35 | −0.22 | 3.5 |
| Swift Current, Assin | 27.34 | 30.05 | −.04 | 10.1 | + 7.0 | 18.9 | 1.3 | 0.60 | −0.04 | 6.0 |
| Calgary, Alberta | 26.28 | 29.96 | −.07 | 17.6 | + 9.2 | 27.5 | 7.7 | 0.15 | −0.38 | 1.5 |
| Banff, Alberta | 25.25 | 30.04 | +.04 | 17.7 | + 5.6 | 25.5 | 9.9 | 1.31 | +0.12 | 13.1 |
| Edmonton, Alberta | 27.56 | 29.97 | −.06 | 11.8 | +10.0 | 19.6 | 4.1 | 1.91 | +1.23 | 19.1 |
| Prince Albert, Sask | 28.37 | 30.03 | −.06 | −1.0 | + 7.4 | 9.2 | −11.3 | 0.35 | −0.62 | 3.5 |
| Battleford, Sask | 28.22 | 30.07 | −.01 | 1.3 | + 7.2 | 9.7 | − 7.0 | 1.16 | +0.76 | 11.2 |
| Kamloops, B. C | 28.80 | 30.06 | +.10 | 26.8 | + 3.8 | 32.7 | 20.9 | 2.71 | +1.89 | 21.1 |
| Victoria, B. C | 30.05 | 30.15 | +.18 | 41.3 | + 2.8 | 45.0 | 37.6 | 4.32 | −1.07 | 2.7 |
| Barkerville, B. C | 25.55 | 29.96 | +.07 | 19.5 | + 1.7 | 25.9 | 13.0 | 5.40 | +2.80 | 54.0 |
| Hamilton, Bermuda | 29.96 | 30.13 | .00 | 62.5 | + 0.5 | 67.2 | 57.7 | 5.78 | +0.84 | |

TABLE VII.—*Heights of rivers referred to zeros of gages, January,, 1904.*

| Stations. | Distance to mouth of river. | Danger line on gage. | Highest water. Height. | Highest water. Date. | Lowest water. Height. | Lowest water. Date. | Mean stage. | Monthly range. |
|---|---|---|---|---|---|---|---|---|
| *Mississippi River.* | Miles. | Feet. | Feet. | | Feet. | | Feet. | Feet. |
| St. Paul, Minn.[1] | 1,954 | 14 | | | | | | |
| Red Wing, Minn.[1] | 1,914 | 14 | | | | | | |
| Reeds Landing, Minn | 1,884 | 12 | 2.3 | 26-31 | 1.2 | 1-5 | 1.7 | 1.1 |
| La Crosse, Wis.[1] | 1,819 | 12 | | | | | | |
| Prairie du Chien, Wis.[1] | 1,759 | 18 | | | | | | |
| Dubuque, Iowa[1] | 1,699 | 18 | | | | | | |
| Leclaire, Iowa[1] | 1,609 | 10 | | | | | | |
| Davenport, Iowa[1] | 1,593 | 15 | | | | | | |
| Muscatine, Iowa | 1,562 | 16 | 6.5 | 21 | 4.8 | 15-19,29-31 | | 1.7 |
| Galland, Iowa[1] | 1,472 | 8 | | | | | | |
| Keokuk, Iowa[1] | 1,463 | 15 | | | | | | |
| Hannibal, Mo.[2] | 1,402 | 13 | 12.2 | 26 | 4.2 | 1, 2 | 7.2 | 8.0 |
| Grafton, Ill.[3] | 1,306 | 23 | 10.2 | 24, 25 | 4.4 | 20 | 6.0 | 5.8 |
| St. Louis, Mo | 1,264 | 30 | 15.4 | 24 | 3.3 | 10 | 6.8 | 12.1 |
| Chester, Ill | 1,189 | 30 | 12.8 | 25 | 3.5 | 13 | 6.0 | 9.3 |
| New Madrid, Mo | 1,003 | 34 | 23.9 | 31 | 6.4 | 17 | 11.2 | 17.5 |
| Memphis, Tenn | 843 | 33 | 19.9 | 31 | 3.1 | 19, 20 | 6.9 | 16.8 |
| Helena, Ark | 767 | 42 | 25.0 | 31 | 5.4 | 20 | 9.6 | 19.6 |
| Arkansas City, Ark | 635 | 42 | 25.5 | 31 | 6.1 | 22, 23 | 10.4 | 19.4 |
| Greenville, Miss | 595 | 42 | 20.6 | 31 | 5.0 | 21-23 | 8.2 | 15.6 |
| Vicksburg, Miss | 474 | 45 | 17.4 | 31 | 3.4 | 24, 25 | 6.3 | 14.0 |
| Natchez, Miss | 373 | 46 | 14.7 | 31 | 6.0 | 1 | 8.6 | 8.7 |
| Baton Rouge, La | 240 | 35 | 6.8 | 31 | 2.8 | 1 | 4.5 | 4.0 |
| Donaldsonville, La | 188 | 28 | 4.2 | 31 | 2.0 | 1 | 3.0 | 2.2 |
| New Orleans, La | 108 | 16 | 4.5 | 22 | 2.6 | 27 | 3.3 | 1.9 |
| *James River.* | | | | | | | | |
| Huron, S. Dak.[1] | 210 | 9 | | | | | | |
| *Missouri River.* | | | | | | | | |
| Bismarck, N. Dak | 1,309 | 14 | 2.0 | 9-11 | 0.1 | 1 | 1.4 | 1.9 |
| Pierre, S. Dak.[1] | 1,114 | 14 | | | | | | |
| *Missouri River*—Cont'd. | | | | | | | | |
| Sioux City, Iowa[1] | 784 | 19 | | | | | | |
| Omaha, Nebr.[1] | 669 | 18 | | | | | | |
| St. Joseph, Mo | 481 | 10 | 4.7 | 27 | 0.1 | 1 | 1.3 | 4.6 |
| Kansas City, Mo | 388 | 21 | 11.9 | 31 | 4.8 | 4 | 7.3 | 7.1 |
| Glasgow, Mo | 231 | | | | | | | |
| Boonville, Mo | 199 | 20 | 9.0 | 17 | 4.1 | 11 | 6.3 | 4.9 |
| Hermann, Mo | 103 | 24 | 11.4 | 22, 23 | 3.6 | 10 | 6.4 | 7.8 |
| *Des Moines River.* | | | | | | | | |
| Des Moines, Iowa[1] | | | | | | | | |
| *Illinois River.* | | | | | | | | |
| Peoria, Ill | 135 | 14 | 16.3 | 29, 30 | 10.0 | 17-20 | 11.8 | 6.3 |
| *Allegheny River.* | | | | | | | | |
| Warren, Pa.[4] | 177 | 14 | 10.2 | 23 | 1.0 | 6-10 | 3.7 | 9.2 |
| Oil City, Pa | 123 | 13 | 13.8 | 23 | 2.0 | 1-4 | 4.7 | 11.8 |
| Parker, Pa | 73 | 20 | 19.0 | 23 | 1.7 | 11-16 | 4.2 | 17.3 |
| Freeport, Pa | 29 | 20 | 31.2 | 23 | 4.8 | 19, 20 | 8.7 | 26.4 |
| *Red Bank Creek.* | | | | | | | | |
| Brookville, Pa | 35 | 8 | 7.2 | 22 | 0.2 | 1-20 | 1.0 | 7.0 |
| *Clarion River.* | | | | | | | | |
| Clarion, Pa | 32 | 10 | 12.5 | 23 | 1.0 | 19, 20 | 2.9 | 11.5 |
| *Conemaugh River.* | | | | | | | | |
| Johnstown, Pa.[5] | 64 | 7 | 11.4 | 22 | 1.4 | 16-18 | 2.8 | 10.0 |
| *Cheat River.* | | | | | | | | |
| Rowlesburg, W. Va | 36 | 14 | 7.8 | 23 | 2.5 | 31 | | 5.3 |
| *Youghiogheny River.* | | | | | | | | |
| Confluence, Pa.[6] | 59 | 10 | 11.6 | 22 | 0.3 | 5 | | 11.3 |
| West Newton, Pa.[7] | 15 | 23 | 22.0 | 22 | 2.0 | 30, 31 | | 20.0 |
| *Monongahela River.* | | | | | | | | |
| Weston, W. Va | 161 | 18 | 2.0 | 21 | 0.1 | 30, 31 | 1.0 | 1.9 |
| Fairmont, W. Va | 119 | 25 | 21.5 | 23 | 14.7 | 11, 31 | 15.8 | 6.8 |

TABLE VII.—*Heights of rivers referred to zeros of gages*—Continued.

| Stations. | Distance to mouth of river. | Danger line on gage. | Highest water. Height. | Highest water. Date. | Lowest water. Height. | Lowest water. Date. | Mean stage. | Monthly range. |
|---|---|---|---|---|---|---|---|---|
| | *Miles.* | *Feet.* | *Feet.* | | *Feet.* | | *Feet.* | *Feet.* |
| *Monongahela River*—Cont'd | | | | | | | | |
| Greensboro, Pa | 81 | 18 | 16.4 | 22 | 7.4 | 12, 15, 17 | 8.8 | 9.0 |
| Lock No. 4, Pa | 40 | 28 | 21.2 | 23 | 6.9 | 14–17 | 9.5 | 14.3 |
| *Ohio River.* | | | | | | | | |
| Pittsburg, Pa | 966 | 22 | 30.0 | 23 | 1.9 | 17, 18 | 6.2 | 28.1 |
| Davis Island Dam, Pa | 960 | 25 | 28.4 | 23 | 4.0 | 17, 18 | 7.8 | 24.4 |
| Beaver Dam, Pa | 925 | 27 | 42.8 | 23 | 5.3 | 9, 10, 18 | 11.5 | 37.5 |
| Wheeling, W. Va | 875 | 36 | 43.9 | 24 | 4.9 | 4 | 14.5 | 39.0 |
| Parkersburg, W. Va | 785 | 36 | 42.4 | 26 | 5.0 | 7, 8 | 12.5 | 37.4 |
| Point Pleasant, W. Va | 703 | 39 | 42.1 | 27 | 3.3 | 7 | 12.1 | 38.8 |
| Huntington, W. Va | 660 | 50 | 43.7 | 27 | 6.5 | 8 | 14.9 | 37.2 |
| Catlettsburg, Ky | 651 | 50 | 44.5 | 27 | 4.4 | 8, 19 | 13.6 | 40.1 |
| Portsmouth, Ohio | 612 | 50 | 44.5 | 27 | 6.1 | 9 | 15.4 | 38.4 |
| Cincinnati, Ohio | 499 | 50 | 43.6 | 28 | 10.7 | 4 | 19.4 | 32.9 |
| Madison, Ind | 413 | 46 | 34.5 | 29 | 10.0 | 4, 12, 13 | 15.8 | 24.5 |
| Louisville, Ky | 367 | 28 | 15.7 | 29, 30 | 4.0 | 7, 8 | 7.2 | 11.7 |
| Evansville, Ind | 184 | 35 | 31.7 | 31 | 5.0 | 14, 15 | 11.3 | 26.7 |
| Paducah, Ky | 47 | 40 | 24.7 | 31 | 4.2 | 16–18 | 9.5 | 20.5 |
| Cairo, Ill | 1 | 45 | 29.6 | 31 | 7.6 | 16–17 | 14.0 | 22.0 |
| *Beaver River.* | | | | | | | | |
| Ellwood Junction, Pa.[8] | 10 | 14 | 16.4 | 23 | 3.9 | 28 | ..... | 12.5 |
| *Muskingum River.* | | | | | | | | |
| Zanesville, Ohio | 70 | 20 | 27.2 | 25 | 7.6 | 15–20 | 11.2 | 19.6 |
| *Little Kanawha River.* | | | | | | | | |
| Glenville, W. Va | 103 | 20 | 3.0 | 17, 23 | −0.4 | 10 | 3.4 | 3.4 |
| *New River.* | | | | | | | | |
| Radford, Va | 155 | 14 | 3.5 | 25 | 0.0 | 8–12 | 0.8 | 3.5 |
| Hinton, W. Va | 95 | 14 | 4.8 | 24 | 1.4 | 7–11, 31 | 1.8 | 3.4 |
| *Great Kanawha, River.* | | | | | | | | |
| Charleston, W. Va | 58 | 30 | 9.8 | 24 | 2.4 | 12 | 4.0 | 7.4 |
| *Scioto River.* | | | | | | | | |
| Columbus, Ohio[9] | 110 | 17 | 18.5 | 23 | 5.4 | 30, 31 | ..... | 13.1 |
| *Licking River.* | | | | | | | | |
| Falmouth, Ky.[6] | 30 | 25 | 7.3 | 22 | 2.0 | 31 | ..... | 5.3 |
| *Miami River.* | | | | | | | | |
| Dayton, Ohio[9] | 77 | 18 | 12.5 | 22 | 3.0 | 30, 31 | ..... | 9.5 |
| *Kentucky River.* | | | | | | | | |
| Beattyville, Ky | 254 | 30 | 4.0 | 23 | 1.0 | 8 | 2.1 | 3.0 |
| High Bridge, Ky | 117 | 17 | 13.2 | 23, 24 | 9.9 | 12 | 10.9 | 3.3 |
| Frankfort, Ky | 65 | 31 | 9.0 | 23–25 | 6.6 | 4, 12, 13 | 7.3 | 2.4 |
| *Wabash River.* | | | | | | | | |
| Mount Carmel, Ill.[10] | 50 | 15 | 18.1 | 31 | 2.0 | 11–21 | 7.7 | 16.1 |
| *Clinch River.* | | | | | | | | |
| Speers Ferry, Va | 156 | 20 | 3.2 | 23 | −0.7 | 5, 6 | 0.3 | 3.9 |
| Clinton, Tenn | 52 | 25 | 11.0 | 25 | 3.0 | 5, 6 | 5.2 | 8.0 |
| *Holston River.* | | | | | | | | |
| Bluff City, Tenn | 170 | 15 | 1.8 | 24 | 0.1 | 5, 11 | 0.7 | 1.7 |
| Rogersville, Tenn | 103 | 14 | 3.4 | 24 | 1.5 | 2 | 1.9 | 1.9 |
| *French Broad River.* | | | | | | | | |
| Asheville, N. C | 144 | 6 | 1.5 | 23 | −0.7 | 2–12 | −0.5 | 2.2 |
| Leadvale, Tenn | 70 | 15 | 1.2 | 24 | −1.3 | 10 | −0.2 | 2.5 |
| *Hiwassee River.* | | | | | | | | |
| Charleston, Tenn | 18 | 22 | 6.4 | 23 | 0.4 | 7–9 | 1.5 | 6.0 |
| *Tennessee River.* | | | | | | | | |
| Knoxville, Tenn | 635 | 29 | 3.7 | 25 | 0.1 | 7, 8 | 1.1 | 3.6 |
| Kingston, Tenn | 556 | 25 | 6.1 | 23 | 1.1 | 11 | 2.4 | 5.0 |
| Chattanooga, Tenn | 452 | 33 | 10.6 | 24 | 1.5 | 9 | 3.6 | 9.1 |
| Bridgeport, Ala | 402 | 24 | 8.4 | 25 | 0.7 | 10, 11 | 2.5 | 7.7 |
| Florence, Ala | 255 | 16 | 8.0 | 26 | 0.3 | 12, 13 | 2.3 | 7.7 |
| Riverton, Ala | 225 | 25 | 10.1 | 26 | −0.3 | 12–14 | 2.6 | 10.4 |
| Johnsonville, Tenn | 95 | 21 | 10.9 | 28 | 1.5 | 16 | 4.0 | 9.4 |
| *Cumberland River.* | | | | | | | | |
| Burnside, Ky | 518 | 50 | 20.4 | 24 | 2.6 | 11 | 6.3 | 17.8 |
| Celina, Tenn | 383 | 45 | 20.2 | 25 | 4.4 | 12 | 8.8 | 15.8 |
| Carthage, Tenn | 308 | 40 | 17.0 | 25 | 3.7 | 12, 13 | 7.5 | 13.3 |
| Nashville, Tenn | 193 | 40 | 20.6 | 26 | 6.0 | 12–14 | 11.2 | 14.6 |
| Clarksville, Tenn | 126 | 42 | 24.4 | 23 | 7.9 | 14 | 14.6 | 16.5 |
| *Arkansas River.* | | | | | | | | |
| Wichita, Kans | 832 | 10 | 0.4 | 10, 11, 14, 20 | −0.1 | 28–31 | 0.2 | 0.5 |
| Webbers Falls, Ind. T | 465 | 23 | 9.8 | 22 | 1.9 | 17–20 | 3.6 | 7.9 |
| Fort Smith, Ark | 403 | 22 | 12.5 | 24 | 1.9 | 19–21 | 4.4 | 10.6 |
| Dardanelle, Ark | 256 | 21 | 12.8 | 25 | 1.6 | 14–21 | 4.7 | 11.2 |
| Little Rock, Ark | 176 | 23 | 15.5 | 26 | 2.9 | 19, 20 | 6.0 | 12.6 |
| *White River.* | | | | | | | | |
| Newport, Ark | 150 | 26 | 22.8 | 26 | 1.2 | 19–21 | 7.1 | 21.6 |
| *Yazoo River.* | | | | | | | | |
| Yazoo City, Miss | 80 | 25 | 3.5 | 31 | −1.1 | 19–22 | 0.7 | 4.6 |
| *Ouachita River.* | | | | | | | | |
| Camden, Ark | 304 | 39 | 23.6 | 26 | 5.2 | 20, 21 | 9.7 | 18.4 |
| Monroe, La | 122 | 40 | 11.5 | 30, 31 | 2.5 | 23–25 | 5.1 | 9.0 |
| *Red River.* | | | | | | | | |
| Arthur City, Tex | 688 | 27 | 8.5 | 25 | 4.0 | 19–22 | 5.0 | 4.5 |
| Fulton, Ark | 515 | 28 | 16.8 | 27 | 5.8 | 20, 21 | 8.7 | 11.0 |
| Shreveport, La | 327 | 29 | 7.1 | 29 | −1.6 | 20, 21 | 0.2 | 8.7 |
| Alexandria, La | 118 | 33 | 1.9 | 31 | −0.6 | 22, 23 | −0.1 | 2.5 |
| *Atchafalaya River.* | | | | | | | | |
| Melville, La | 100 | 31 | 10.5 | 31 | 4.8 | 1 | 7.2 | 5.7 |
| *Penobscot River.* | | | | | | | | |
| Mattawamkeag, Me.[1] | 87 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Montague, Me.[1] | 60 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| *Kennebec River.* | | | | | | | | |
| Winslow, Me | 46 | ..... | 4.4 | 29 | 1.8 | 4, 10 | 3.4 | 2.6 |
| *Merrimac River.* | | | | | | | | |
| Franklin Junction, N. H.[11] | 110 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Concord, N. H.[1] | 94 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Manchester, N. H | 68 | ..... | 3.6 | 31 | 2.9 | 28 | 2.8 | 0.7 |
| *Connecticut River.* | | | | | | | | |
| Wells River, Vt.[1] | 255 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| White River Junction, Vt.[1] | 209 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Bellows Falls, Vt | 170 | 12 | 2.2 | 3 | 0.0 | 23 | 1.0 | 2.2 |
| Holyoke, Mass | 84 | 9 | 2.8 | 17, 31 | 0.2 | 30 | 1.3 | 2.6 |
| Hartford, Conn | 50 | 13 | 4.5 | 1, 4 | 2.6 | 18 | 3.9 | 1.9 |
| *Housatonic River.* | | | | | | | | |
| Gaylordsville, Conn | 50 | 15 | 9.5 | 25 | 4.0 | 3, 4, 8, 9 | 6.1 | 5.5 |
| *Mohawk River.* | | | | | | | | |
| Utica, N. Y.[12] | 98 | ..... | 5.0 | 24 | 0.9 | 2 | 1.7 | 4.1 |
| Fort Hunter, N. Y | 42 | ..... | 9.0 | 24, 25 | 2.0 | 1–16 | 4.1 | 7.0 |
| Schenectady, N. Y | 19 | ..... | 2.0 | 23–26 | 1.3 | 2–22 | 1.5 | 0.7 |
| *Hudson River.* | | | | | | | | |
| Glens Falls, N. Y | 197 | ..... | 1.3 | 24–31 | −1.5 | 21 | 0.0 | 2.8 |
| Mechanicsville, N. Y | 166 | ..... | 2.9 | 24 | 0.3 | 22 | 1.1 | 2.6 |
| Troy, N. Y.[13] | 154 | ..... | 8.1 | 25 | 0.0 | 1, 17, 20 | 2.0 | 8.1 |
| Albany, N. Y | 147 | ..... | 4.4 | 26 | 1.5 | 11 | 3.0 | 2.9 |
| Stuyvesant, N. Y | 128 | ..... | 4.4 | 20 | −0.6 | 15, 16 | 1.5 | 5.0 |
| *Passaic River.* | | | | | | | | |
| Chatham, N. J.[14] | 69 | ..... | 7.6 | 24 | 2.7 | 2–4 | 4.4 | 4.9 |
| *Pompton River.* | | | | | | | | |
| Pompton Plains, N. J.[15] | 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| *East Branch Susquehanna.* | | | | | | | | |
| Binghamton, N. Y | 306 | 16 | 8.4 | 25 | 2.8 | 13, 14, 21, 22 | 4.0 | 5.6 |
| Towanda, Pa.[4] | 262 | 16 | 12.0 | 24 | 2.6 | 1–3 | 4.4 | 9.4 |
| Wilkesbarre, Pa | 183 | 17 | 20.5 | 23 | 5.6 | 20, 21 | 8.3 | 14.9 |
| *West Branch Susquehanna.* | | | | | | | | |
| Lockhaven, Pa.[17] | 65 | 12 | 8.5 | 23 | 2.0 | 28 | ..... | 6.5 |
| Williamsport, Pa | 39 | 20 | 16.0 | 23 | 1.4 | 21 | 3.1 | 14.6 |
| *Susquehanna River.* | | | | | | | | |
| Selinsgrove, Pa.[16] | 116 | 17 | 10.3 | 24 | 1.8 | 2 | ..... | 8.5 |
| Harrisburg, Pa | 69 | 17 | 15.5 | 24 | 2.2 | 1, 2 | 4.9 | 13.3 |
| *Juniata River.* | | | | | | | | |
| Huntingdon, Pa.[13] | 90 | 24 | 7.3 | 23 | 4.7 | 26 | ..... | 2.6 |
| *Potomac River.* | | | | | | | | |
| Cumberland, Md.[18] | 290 | 8 | 7.3 | 23 | 1.4 | 5–8 | 2.4 | 5.9 |
| Harpers Ferry, W. Va | 172 | 18 | 6.4 | 25 | 0.0 | 1, 2, 14–16 | 1.2 | 6.4 |
| *Shenandoah River.* | | | | | | | | |
| Riverton, Va | 58 | 22 | 3.0 | 24 | −0.5 | 1–23 | −0.2 | 3.5 |
| *James River.* | | | | | | | | |
| Lynchburg, Va.[5] | 260 | 18 | 3.7 | 24 | 0.3 | 1–3, 9–11 | 1.0 | 3.4 |
| Richmond, Va | 111 | 12 | 0.6 | 26 | −1.6 | 19, 20 | −0.5 | 2.2 |
| *Dan River.* | | | | | | | | |
| Danville, Va.[18] | 55 | 8 | 0.6 | 24 | −0.2 | 4–7, 19–22 | 0.0 | 0.8 |
| *Roanoke River.* | | | | | | | | |
| Clarksville, Va | 196 | 12 | 4.7 | 25 | 3.4 | 1 | 3.9 | 1.3 |
| Weldon, N. C | 129 | 30 | 10.8 | 24, 25 | 8.5 | 8 | 9.4 | 2.3 |
| *Cape Fear River.* | | | | | | | | |
| Fayetteville, N. C | 112 | 38 | 15.0 | 25 | 2.9 | 11 | 4.9 | 12.1 |
| *Waccamaw River.* | | | | | | | | |
| Conway, S. C | 40 | 7 | 3.8 | 31 | 1.0 | 15 | 2.2 | 2.8 |
| *Pedee River.* | | | | | | | | |
| Cheraw, S. C | 149 | 27 | 10.4 | 24 | 1.8 | 10, 11 | 2.8 | 8.6 |
| Smiths Mills, S. C | 51 | 16 | 9.0 | 29 | 3.7 | 11, 12 | 4.9 | 5.3 |
| *Lynch Creek.* | | | | | | | | |
| Effingham, S. C | 35 | 12 | 7.4 | 31 | 4.3 | 3–5, 19, 20 | 4.9 | 3.1 |
| *Black River.* | | | | | | | | |
| Kingstree, S. C | 52 | 12 | 7.2 | 31 | 5.0 | 16–18 | 6.1 | 2.2 |
| *Wateree River.* | | | | | | | | |
| Camden, S. C | 45 | 24 | 15.0 | 23 | 5.7 | 9 | 6.8 | 9.3 |
| *Congaree River.* | | | | | | | | |
| Columbia, S. C | 37 | 15 | 3.5 | 23 | −0.1 | 1, 2 | 0.3 | 3.6 |
| *Santee River.* | | | | | | | | |
| St. Stephens, S. C | 50 | 12 | 7.5 | 28 | 1.3 | 9 | 3.1 | 6.2 |
| *Savannah River.* | | | | | | | | |
| Calhoun Falls, S. C | 347 | 15 | 6.9 | 23 | 2.1 | 1, 8, 9, 12–14 | 2.8 | 4.8 |
| Augusta, Ga | 268 | 32 | 13.0 | 24 | 6.7 | 8 | 8.0 | 6.3 |
| *Broad River.* | | | | | | | | |
| Carlton, Ga | 30 | 11 | 3.8 | 23 | 2.2 | 1, 2, 5–10, 20–22 | 2.4 | 1.6 |
| *Oconee River.* | | | | | | | | |
| Dublin, Ga | 79 | 30 | 7.8 | 26 | 1.4 | 8, 9, 11, 12 | 2.8 | 6.4 |
| *Ocmulgee River.* | | | | | | | | |
| Macon, Ga | 125 | 18 | 12.6 | 23 | 2.1 | 3 | 3.9 | 10.5 |
| Abbeville, Ga | 50 | 11 | 9.4 | 30 | 3.4 | 4 | 5.7 | 6.0 |
| *Flint River.* | | | | | | | | |
| Woodbury, Ga | ..... | ..... | 3.2 | 23 | 0.5 | 1, 2, 6 | 1.1 | 2.7 |
| Albany, Ga | 80 | 20 | 10.2 | 29 | 4.6 | 9 | 6.9 | 5.6 |
| *Chattahoochee River.* | | | | | | | | |
| Oakdale, Ga | 305 | 18 | 4.0 | 23, 24 | 1.3 | 1, 2, 4–6, 9, 12 | 2.0 | 2.7 |
| Westpoint, Ga | 239 | 20 | 5.5 | 23 | 2.3 | 2, 6, 7 | 3.0 | 3.2 |
| Eufaula, Ala | 90 | 40 | 14.7 | 23, 24 | 2.4 | 6, 7 | 5.9 | 12.3 |
| *Coosa River.* | | | | | | | | |
| Rome, Ga | 271 | 30 | 5.9 | 24 | 0.8 | 6–16 | 1.6 | 5.1 |
| Gadsden, Ga | 144 | 22 | 6.7 | 25 | −0.2 | 8, 9 | 1.3 | 6.9 |
| Lock No. 4, Ala | 116 | 17 | 5.6 | 25 | 0.3 | 5–7, 9, 10 | 1.5 | 5.3 |
| Wetumpka, Ala | 6 | 45 | 12.6 | 24 | 2.0 | 7 | 5.3 | 10.6 |
| *Tallapoosa River.* | | | | | | | | |
| Milstead, Ala | 38 | 35 | 9.8 | 24 | 2.0 | 2, 3 | 3.7 | 7.8 |
| *Alabama River.* | | | | | | | | |
| Montgomery, Ala | 265 | 35 | 10.5 | 24 | 0.8 | 7 | 3.5 | 9.7 |
| Selma, Ala | 212 | 35 | 12.9 | 25 | 0.9 | 6, 7 | 4.5 | 12.0 |
| *Tombigbee River.* | | | | | | | | |
| Columbus, Miss.[12] | 303 | 33 | 2.0 | 29 | −2.0 | 17, 21 | −1.0 | 4.0 |
| Demopolis, Ala.[12] | 155 | 35 | 8.6 | 26 | −0.3 | 6, 7 | 2.8 | 8.9 |
| *Black Warrior River.* | | | | | | | | |
| Tuscaloosa, Ala | 90 | 43 | 12.7 | 24 | 4.9 | 5, 6 | 6.3 | 7.8 |
| *Sabine River.* | | | | | | | | |
| Logansport, La | 180 | 25 | 6.5 | 31 | 2.4 | 18–21 | 3.5 | 4.1 |
| Orange, Tex | 10 | 7 | −1.4 | 1–9, 26–31 | −1.8 | 18, 19 | −1.5 | 0.4 |
| *Neches River.* | | | | | | | | |
| Rockland, Tex | 110 | 20 | 2.6 | 1 | 1.0 | 24–26 | 1.4 | 1.6 |
| Beaumont, Tex | 40 | 10 | 1.5 | 21 | −1.0 | 3 | 0.0 | 2.5 |
| *Trinity River.* | | | | | | | | |
| Dallas, Tex | 330 | 25 | 5.7 | 23 | 2.0 | 18–20 | 2.8 | 3.7 |
| Riverside, Tex | 100 | 40 | 3.0 | 30 | 0.8 | 21 | 1.4 | 2.2 |
| Liberty, Tex | 42 | 25 | 7.1 | 1 | 3.9 | 24, 27, 28 | 4.6 | 3.2 |
| *Brazos River.* | | | | | | | | |
| Kopperl, Tex | 369 | 21 | −0.4 | 1, 2 | −1.0 | 22–31 | −0.8 | 0.6 |
| Waco, Tex | 301 | 24 | 2.3 | 1–13 | 2.2 | 14–31 | 2.2 | 0.1 |
| Hempstead, Tex | 215 | 40 | −0.4 | 1 | −1.3 | 26–31 | −0.9 | 0.9 |
| Booth, Tex | 76 | 39 | 4.2 | 1 | 1.3 | 24–31 | 2.1 | 2.9 |

TABLE VII.—*Heights of rivers referred to zeros of gages.*—Continued.

| Stations. | Distance to mouth of river. | Danger line on gage. | Highest water. Height. | Highest water. Date. | Lowest water. Height. | Lowest water. Date. | Mean stage. | Monthly range. |
|---|---|---|---|---|---|---|---|---|
| *Colorado River.* | *Miles.* | *Feet.* | *Feet.* | | *Feet.* | | *Feet.* | *Feet.* |
| Ballinger, Tex | 400 | 21 | 1.9 | 21–24 | 0.9 | 11–19 | 1.3 | 1.0 |
| Austin, Tex | 214 | 18 | 1.2 | 1–31 | 1.2 | 1–31 | 1.2 | 0.0 |
| Columbus, Tex | 100 | 24 | 6.0 | 1–11, 24–31 | 5.5 | 14–23 | 5.8 | 0.5 |
| *Red River of the North.* | | | | | | | | |
| Moorhead, Minn.[1] | 418 | 26 | ..... | ..... | ..... | ..... | ..... | ..... |
| *Columbia River.* | | | | | | | | |
| Umatilla, Oreg | 270 | 25 | 2.8 | 1–3 | 1.7 | 30, 31 | 2.2 | 1.1 |
| *Columbia River*—Cont'd. | *Miles.* | *Feet.* | *Feet.* | | *Feet.* | | *Feet.* | *Feet.* |
| The Dalles, Oreg | 166 | 40 | 5.1 | 18 | 3.2 | 29 | 4.3 | 1.9 |
| *Willamette River.* | | | | | | | | |
| Albany, Oreg.[12] | 118 | 20 | 15.6 | 12 | 4.2 | 1–3 | 7.9 | 11.4 |
| Portland, Oreg | 12 | 15 | 10.2 | 14 | 3.7 | 1 | 6.6 | 6.5 |
| *Sacramento River.* | | | | | | | | |
| Red Bluff, Cal | 265 | 23 | 5.0 | 18, 19 | 2.8 | 16, 17 | 3.6 | 2.2 |
| Sacramento, Cal | 64 | 25 | 15.8 | 2 | 13.3 | 31 | 14.4 | 2.5 |

[1] Frozen entire month. [2] Frozen for 8 days. [3] Frozen for 1 day. [4] Frozen for 11 days. [5] Frozen for 7 days. [6] Frozen for 16 days. [7] Frozen for 21 days. [8] Frozen for 24 days. [9] Frozen for 20 days. [10] Frozen for 9 days. [11] Frozen for 28 days. [12] 30 days only. [13] 28 days only [14] Frozen for 14 days. [15] Gage broken. [16] Frozen for 18 days. [17] Frozen for 25 days. [18] Frozen for 2 days.

## HAWAIIAN CLIMATOLOGICAL DATA.

By R. C. LYDECKER, Territorial Meteorologist.

*Rainfall data for January, 1904.*

| Stations. | Elevation. | Amount. |
|---|---|---|
| HAWAII. | | |
| HILO, e. and ne. | *Feet.* | *Inches.* |
| Waiakea | 50 | 22.87 |
| Hilo (town) | ..... | ..... |
| Puueo | 85 | 27.61 |
| Kaumana | 1,250 | 31.48 |
| Pepeekeo | 100 | 24.24 |
| Hakalau | 200 | 28.30 |
| Honohina | 300 | 27.62 |
| Puuohua | 1,050 | 35.95 |
| Laupahoehoe | 500 | 24.67 |
| Ookala | 400 | 19.05 |
| HAMAKUA, ne. | | |
| Kukaiau | 250 | 15.03 |
| Paauilo | 300 | 13.68 |
| Paauhau | 300 | 10.68 |
| Honokaa (Mill) | 425 | 12.24 |
| Honokaa (Meinicke) | 1,100 | 16.84 |
| Kukuihaele | 700 | 12.24 |
| KOHALA, n. | | |
| Awini Ranch | 1,100 | 11.02 |
| Niulii | 200 | 6.99 |
| Kohala (Mission) | 521 | 6.63 |
| Kohala (Sugar Co.) | 270 | 6.56 |
| Hawi Mill | 700 | 6.38 |
| Puakea Ranch | 600 | 4.18 |
| Puuhue Ranch | 1,847 | 8.18 |
| Waimea | 2,730 | 16.52 |
| KONA, w. | | |
| Huehue | 2,000 | 3.15 |
| Holualoa | 1,350 | 1.45 |
| Kaukahoku Leheula | ..... | ..... |
| Kainaliu | ..... | ..... |
| Kealakekua | 1,580 | 4.41 |
| Napoopoo | 25 | 2.10 |
| Hoopuloa | ..... | ..... |
| Hoopuloa | ..... | ..... |
| Puuwaawaa Ranch | ..... | ..... |
| Huehue | ..... | ..... |
| KAU, se. | | |
| Kahuku Ranch | 1,680 | 4.61 |
| Honuapo | 15 | 3.61 |
| Naalehu | 650 | 5.15 |
| Hilea | 310 | 3.90 |
| Pahala | 850 | 2.65 |
| Moaula | ..... | ..... |
| Volcano House | 4,000 | 16.19 |
| PUNA, e. | | |
| Olaa, Mountain View (Russel) | 1,530 | 48.75 |
| Olaa Plantation (Mill) | 210 | 31.77 |
| Kapoho | 110 | 19.69 |
| Pahoa | 600 | 28.31 |
| MAUI. | | |
| Lahaina | ..... | ..... |
| Waiopae Ranch | 700 | 2.96 |
| Kaupo (Mokulau), s | 285 | 17.19 |
| Kipahulu, s | 308 | 14.30 |
| Hana | ..... | ..... |
| Nahiku, ne | 850 | 31.21 |
| Nahiku | 1,600 | 45.51 |
| Haiku, n | 700 | 11.90 |
| Kula (Erehwon), n | 4,500 | 11.21 |
| Kula (Waiakoa), n | 2,700 | 7.49 |
| Puuomalei, n | 1,400 | 16.17 |
| Paia | ..... | ..... |
| Haleakala Ranch | 2,000 | 24.16 |
| Wailuku, ne | 250 | 2.50 |

| Stations. | Elevation. | Amount. |
|---|---|---|
| LANAI. | *Feet.* | *Inches.* |
| Keomuku | 10 | 0.10 |
| OAHU. | | |
| Punahou (W. B.), sw | 47 | 5.45 |
| Kulaokahua (Castle), sw | 50 | 4.09 |
| Makiki Reservoir | 120 | 6.83 |
| U. S. Naval Station, sw | 6 | 3.78 |
| Kapiolani Park, sw | 10 | 3.19 |
| College Hills | 175 | 7.43 |
| Manoa (Woodlawn Dairy), c | 285 | 11.60 |
| Manoa (Rhodes Gardens) | 360 | 15.14 |
| Insane Asylum | 30 | 5.47 |
| School street (Bishop), sw | ..... | ..... |
| Kamehameha School | ..... | ..... |
| Kalihi-Uka, sw | 485 | 14.18 |
| Nuuanu (W. W. Hall), sw | 50 | 7.20 |
| Nuuanu (Wyllie street) | 250 | 10.75 |
| Nuuanu (Elec. Station), sw | 405 | 10.88 |
| Nuuanu (Luakaha), c | 850 | 17.71 |
| U. S. Experiment Station | 350 | 9.73 |
| Kaliula | 1,150 | 15.65 |
| Laniakea (Nahuina) | ..... | ..... |
| Tantalus Heights (Frear) | 1,360 | 14.24 |
| Waimanalo, ne | 25 | 2.82 |
| Maunawili, ne | 300 | 5.95 |
| Kaneohe | 100 | 3.69 |
| Ahuimanu, ne | 350 | 9.17 |
| Kahuku, n | ..... | ..... |
| Waialua | ..... | ..... |
| Wahiawa | 900 | 7.73 |
| Ewa Plantation, s | 60 | 1.32 |
| U. S. Magnetic Station | ..... | ..... |
| Waipahu | 200 | 2.75 |
| Moanalua | 15 | 5.95 |
| Pacific Heights | ..... | ..... |
| KAUAI. | | |
| Lihue (Grove Farm), e | 200 | 3.56 |
| Lihue (Molokoa), e | 300 | 3.97 |
| Lihue (Kukaua), e | 1,000 | 8.54 |
| Lihue (Kilohana) | 400 | 4.74 |
| Kealia, e | 15 | 3.21 |
| Kilauea (Plantation), ne | 325 | 5.37 |
| Hanalei, n | 10 | 11.74 |
| Waioli | ..... | ..... |
| Haena | ..... | ..... |
| Waiawa | 32 | 0.81 |
| Eleele | 150 | ..... |
| Wahiawa (Mountain) | 3,000 | 22.00 |
| McBryde (Residence) | 850 | 11.82 |
| Lawai (Gov. Road) | 450 | 10.52 |
| Lawai, w | 225 | 3.50 |
| Lawai, e | 800 | 10.05 |
| Koloa | 100 | 3.38 |
| Lawai Beach | ..... | 3.86 |
| *Delayed December reports.* | | |
| U. S. Experiment Station | ..... | 2.29 |
| Kukaiau Mill | ..... | 2.67 |
| Kaliula | ..... | 3.61 |
| Kapoho | ..... | 2.16 |
| Pahala | ..... | 1.55 |
| Ookala | ..... | 2.80 |
| Kaumana | ..... | 7.64 |
| Napoopoo | ..... | 0.00 |
| Honokaa | 1,100 | 2.91 |
| Paia | ..... | 3.62 |
| Puuomalei | ..... | 7.74 |
| Kula (Erehwon) | ..... | 1.00 |

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

GENERAL SUMMARY FOR JANUARY, 1904.

*Honolulu.*—Temperature mean for the month, 71.5°; normal, 70.3°; average daily maximum, 76.3°; average daily minimum, 67.6°; mean daily range, 8.7°; greatest daily range, 19°; least daily range, 4°; highest temperature, 79°; lowest temperature, 58°.

Barometer average, 30.030; normal, 29.972; highest, 30.17, 8th, 13th, and 14th; lowest, 29.81, 27th; greatest 24-hour change, that is from any given hour of one day to the same hour on the next, .10; lows passed this point 25th to 28th, inclusive; highs, 1st to 20th and 29th to 30th.

Relative humidity average, 72.9; normal, 76.6 per cent;

### *Meteorological Observations at Honolulu, January, 1904.*

The station is at 21° 18′ north, 157° 50′ west. It is the Hawaiian Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.)

Hawaiian standard time is $10^h$ $30^m$ slow of Greenwich time. Honolulu local mean time is $10^h$ $31^m$ slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

Rainfall for twenty-four hours is measured at 9 a. m. local, or 7:31 p. m., Greenwich time.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

| Date. | Pressure at sea level. | Temperature. Dry bulb. | Temperature. Wet bulb. | During twenty-four hours preceding 1 p. m. Greenwich time, or 2:30 a. m. Honolulu time. Temperature. Maximum. | Temperature. Minimum. | Means. Dew-point. | Means. Relative humidity. | Wind. Prevailing direction. | Wind. Force. | Average cloudiness. | Sea-level pressures. Maximum. | Sea-level pressures. Minimum. | Total rainfall at 9 a. m., local time. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | * | † | † | | | ‡ | ‡ | | § | | | | |
| 1 | 30.04 | 73 | 68 | 76 | 70 | 64.7 | 78 | ne. | 2–3 | 6 | 30.09 | 30.00 | 0.35 |
| 2 | 30.05 | 74 | 68 | 79 | 72 | 66.7 | 81 | ne. | 1–0 | 5 | 30.08 | 30.00 | 0.29 |
| 3 | 30.07 | 72 | 65 | 79 | 70 | 66.0 | 77 | ne. | 3–1 | 3–5 | 30.10 | 30.01 | 0.18 |
| 4 | 30.06 | 72 | 66 | 77 | 71 | 62.7 | 71 | ne. | 2–4 | 4 | 30.11 | 30.03 | 0.16 |
| 5 | 30.07 | 70 | 65.5 | 79 | 70 | 62.5 | 69 | ne. | 1–0 | 1 | 30.09 | 30.01 | 0.12 |
| 6 | 30.09 | 72 | 66 | 77 | 67 | 63.7 | 74 | ne. | 2–0 | 5 | 30.12 | 30.03 | 0.05 |
| 7 | 30.10 | 71 | 66 | 78 | 71 | 64.0 | 73 | ne. | 1–0 | 1 | 30.16 | 30.06 | 0.09 |
| 8 | 30.14 | 70 | 65.5 | 78 | 70 | 63.5 | 73 | ne. | 3–0 | 3 | 30.15 | 30.06 | 0.18 |
| 9 | 30.11 | 65 | 62 | 77 | 69 | 62.7 | 72 | ne. | 2–0 | 2 | 30.17 | 30.10 | 0.25 |
| 10 | 30.04 | 59 | 57 | 79 | 63 | 60.5 | 75 | nne.-se. | 1–0 | 1–4 | 30.13 | 30.03 | 0.00 |
| 11 | 30.05 | 66 | 64 | 77 | 58 | 59.7 | 78 | sw. | 0 | 0–4 | 30.07 | 29.96 | 0.00 |
| 12 | 30.09 | 68 | 60 | 75 | 65 | 61.0 | 75 | sw.-nne. | 0–2 | 10–2 | 30.10 | 29.99 | 0.00 |
| 13 | 30.10 | 70 | 64 | 75 | 66 | 57.5 | 66 | ne. | 1–4 | 1–4 | 30.13 | 30.04 | 0.10 |
| 14 | 30.13 | 71 | 64 | 78 | 68 | 62.5 | 71 | ne. | 2–0 | 7–3 | 30.17 | 30.10 | 0.11 |
| 15 | 30.10 | 70 | 65.5 | 75 | 69 | 61.0 | 69 | ne. | 1–4 | 6 | 30.17 | 30.06 | 0.03 |
| 16 | 30.05 | 69 | 65 | 75 | 67 | 62.7 | 74 | ne. | 2–4 | 4 | 30.11 | 30.02 | 0.28 |
| 17 | 30.01 | 73 | 64.5 | 75 | 69 | 63.7 | 75 | ne. | 2–4 | 5 | 30.08 | 30.01 | 0.58 |
| 18 | 30.06 | 71 | 64.5 | 76 | 72 | 60.5 | 68 | ne. | 4–6 | 4 | 30.07 | 29.97 | 0.10 |
| 19 | 30.02 | 71 | 64.5 | 75 | 69 | 61.3 | 70 | ne. | 5–2 | 4–7 | 30.11 | 30.01 | 0.10 |
| 20 | 30.04 | 70 | 64 | 76 | 70 | 59.7 | 66 | ne. | 6–2 | 4 | 30.08 | 30.02 | 0.19 |
| 21 | 30.01 | 70 | 62 | 75 | 68 | 59.0 | 66 | ne. | 5–2 | 4 | 30.08 | 30.01 | 0.30 |
| 22 | 29.97 | 70 | 63.5 | 76 | 70 | 58.5 | 68 | ne. | 2–0 | 2–4 | 30.04 | 29.96 | 0.01 |
| 23 | 30.00 | 70 | 63 | 76 | 67 | 60.5 | 66 | ne. | 1–0 | 3–8 | 30.02 | 29.94 | 0.07 |
| 24 | 30.00 | 70 | 63 | 76 | 68 | 60.3 | 69 | ne. | 2–0 | 3–5 | 30.03 | 29.95 | 0.19 |
| 25 | 29.95 | 69 | 62.5 | 74 | 67 | 58.3 | 67 | nne. | 4–1 | 7–4 | 30.04 | 29.93 | 0.92 |
| 26 | 29.91 | 69 | 63 | 75 | 68 | 59.3 | 69 | n. | 1–2 | 4 | 29.99 | 29.90 | 0.07 |
| 27 | 29.89 | 66 | 62.5 | 72 | 67 | 59.0 | 69 | nnw-nne | 1–5 | 6 | 29.96 | 29.86 | 0.13 |
| 28 | 29.88 | 67 | 66.5 | 72 | 66 | 62.5 | 85 | nne. | 2–0 | 6 | 29.92 | 29.81 | 0.20 |
| 29 | 29.98 | 63 | 62 | 77 | 64 | 66.0 | 87 | sse. | 1–0 | 7–4 | 30.01 | 29.86 | 0.51 |
| 30 | 30.00 | 63 | 62 | 77 | 62 | 62.3 | 80 | calm. | 0 | 1–8 | 30.05 | 29.96 | 0.08 |
| 31 | 29.95 | 65 | 64 | 78 | 62 | 62.7 | 80 | se. | 0 | 5 | 30.06 | 29.95 | 0.12 |
| Sums | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 5.76 |
| Means | 30.031 | 69.0 | 64.0 | 76.3 | 67.6 | 61.8 | 72.9 | ..... | 1.7 | 4.2 | 30.080 | 29.988 | ..... |
| Departure. | +.058 | ..... | ..... | ..... | ..... | —0.9 | —3.7 | ..... | ..... | —0.2 | ..... | ..... | +2.66 |

Mean temperature for the month of January, 1904, $(6 + 2 + 9) \div 3 = 71.5°$; normal is 70.3°.
Mean pressure for the month of January, 1904, $(9 + 3) \div 2 = 30.030$; normal is 29.972.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4:31 p. m., Greenwich time. ‡ These values are the means of $(6 + 9 + 2 + 9) \div 4$. § Beaufort scale.

Maximum thermometer set at 9 p. m. and minimum at 2 p. m., local time.

mean dew-point, 61.7°; normal, 62.6°; mean absolute moisture, 6.05 grains per cubic foot; normal, 6.27 grains.

Rainfall, 5.76 inches; normal, 3.10 inches; greatest rainfall in one day, 0.92 inch (from 9 a. m., 23d, to 9 a. m. 24th); rain record days, 28; normal, 16; total at Luakaha, 17.71; normal, 9.15; at Kapiolani Park, 3.19; normal, 2.01.

The artesian well water level rose from 33.40 to 33.93 feet above mean sea level. January 31, 1903, it stood at 35.06. The average daily mean sea level for the month was 9.77, the assumed annual mean being 10 feet above datum. For January, 1903, it was 9.71.

Trade wind days, 25 (4 nne.); normal, 14; average force of wind during daylight, Beaufort scale, 1.7; average cloudiness, tenths of sky, 4.2; normal, 4.4.

Approximate percentages of district rainfall as compared with normal: Hawaii, Hilo district, 227 per cent; Hamakua, 181; Kohala, 131; Waimea, 427; Kona, 120; Kau, 148; Puna, 296; island of Maui, 323; island of Oahu, Honolulu district, 201; Nuuanu, 202; Koolau, 144; Ewa, 80; island of Kauai, variable from 35 at Waiawa to 170 at Hanalei.

The heaviest monthly rainfall reported was at Olaa, 1530 feet elevation, 48.75 inches. The heaviest 24-hour rainfalls were at Waimea, 6.55 inches on the 27th; Olaa Mill, 6.40 inches on the 5th; Pahoa, 6.10 inches on the 27th. All on the Island of Hawaii.

*Temperature table for January, 1904.*

| Stations. | Elevation. | Mean max. | Mean min. | Cor. av'ge. | Highest. | Lowest. |
|---|---|---|---|---|---|---|
| | *Feet.* | ° | ° | ° | ° | ° |
| Hilo | 40 | 73.6 | 63.0 | 67.6 | 81 | 59 |
| Pepeekeo | 100 | 75.0 | 65.6 | 69.6 | 79 | 63 |
| Olaa Mill | 210 | 81.0 | 61.0 | 70.3 | 85 | 57 |
| Kohala | 521 | 74.0 | 63.6 | 68.1 | 81 | 61 |
| Waimea | 2,730 | 72.6 | 56.0 | 63.6 | 82 | 50 |
| Volcano House | 4,000 | 67.5 | 48.7 | 57.4 | 72 | 44 |
| Waiakoa | 2,700 | 75.0 | 54.7 | 64.2 | 80 | 51 |
| Keomuku | 10 | 78.3 | 71.2 | 74.1 | 86 | 66 |
| Kinau | 50 | 75.6 | 67.6 | 70.7 | 79 | 51 |
| Ewa Plantation | 60 | 79.2 | 64.2 | 71.0 | 82 | 57 |
| United States Experiment Station | 350 | 77.9 | 65.9 | 71.2 | 81 | 59 |

Kohala, dew-point, 63.0°; relative humidity, 80.4 per cent.

Ewa plantation, dew-point, 62.0°; relative humidity, 71 per cent; barometer mean, 30.01.

The record for the month was an exceptional one. Temperature, pressure, rainfall, and trade wind days all considerably above the January normal; the barometer especially so, making the seventh consecutive month of pressure above the normal.



Activity of the crater Halemaumau in Kilauea ceased toward the end of the mouth.

Lunar halo 1st; lightning to the southeast on the evening of the 2d; bright afterglow on the 9th; dew on five mornings.

Reported from other stations: Hilo, thunder and lightning 3d and 4th; slight earthquake on 23d at 9:40 p. m. Pepeekeo, thunder and lightning on 2d, 5th, and 26th; heavy snow on mountains, 5th to 11th and 22d to 31st; heavy earthquake, 23d at 9:38 p. m.; high surf 1st to 27th; winds from north to east all the month; dew 3 mornings; average cloudiness, 7.8; mean force of wind, 1.9. Kohala, earthquake on 23d at 9:48 p. m.; trade winds throughout. Waimea, earthquake on 23d; winds variable, from calms to strong northeast gales, 19th and 20th; heavy rain 24th to 28th, inclusive, 14.57 inches falling; heavy snows on Mauna Loa and Mauna Kea; bright afterglow on 7th.

## CLIMATOLOGICAL DATA FOR JAMAICA.

Through the kindness of Mr. H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following table in advance of the regular monthly weather report for Jamaica:

*Comparative table of rainfall for January, 1904.*

[Based upon the average stations only.]

| Divisions. | Relative area. | Number of stations. | Rainfall. | |
|---|---|---|---|---|
| | | | 1904. | Average. |
| | *Per cent.* | | *Inches.* | *Inches.* |
| Northeastern division | 25 | 24 | 5.88 | 6.93 |
| Northern division | 22 | 49 | 2.60 | 3.44 |
| West-central division | 26 | 24 | 3.01 | 2.66 |
| Southern division | 27 | 32 | 2.17 | 1.81 |
| Means | 100 | 201 | 3.42 | 3.71 |

The rainfall for January was, therefore, below the average for the whole island. The greatest fall, 19.28 inches, occurred at Mount Holstein in the northeastern division, while 0.01 inch fell at Plumb Point lighthouse in the southern division.

## COSTA RICAN CLIMATOLOGICAL DATA.

Communicated by Mr. H. PITTIER, Director, Physico-Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San José de Costa Rica, during January, 1904.*

| Hours. | Pressure. Observed, 1904. | Pressure. Normal, 1889-1903. | Temperature. Observed, 1904. | Temperature. Normal, 1889-1903. | Relative humidity. Observed, 1904. | Relative humidity. Normal, 1889-1903. | Rainfall. Observed, 1904. | Rainfall. Normal, 1889-1903. | Rainfall. Duration, 1904. |
|---|---|---|---|---|---|---|---|---|---|
| | *Inches.* | *Inches.* | ° *F.* | ° *F.* | % | % | *Ins.* | *Ins.* | *Hrs.* |
| 1 a. m | 26.16 | 26.15 | 61.2 | 61.5 | 85 | 84 | ...... | 0.01 | ...... |
| 2 a. m | 26.14 | 26.13 | 60.9 | 61.1 | 85 | 84 | ...... | ...... | ...... |
| 3 a. m | 26.13 | 26.11 | 60.3 | 60.7 | 86 | 86 | ...... | T. | ...... |
| 4 a. m | 26.12 | 26.11 | 59.9 | 60.4 | 86 | 85 | T. | 0.01 | 0.67 |
| 5 a. m | 26.13 | 26.12 | 59.5 | 60.3 | 86 | 86 | 0.01 | 0.01 | 0.67 |
| 6 a. m | 26.14 | 26.13 | 59.0 | 59.3 | 88 | 86 | ...... | 0.01 | ...... |
| 7 a. m | 26.15 | 26.14 | 59.2 | 59.4 | 85 | 86 | ...... | 0.01 | ...... |
| 8 a. m | 26.16 | 26.16 | 61.7 | 61.9 | 80 | 80 | ...... | 0.01 | ...... |
| 9 a. m | 26.18 | 26.17 | 66.1 | 66.6 | 68 | 72 | 0.02 | 0.01 | 0.67 |
| 10 a. m | 26.18 | 26.17 | 70.2 | 70.0 | 64 | 67 | 0.14 | ...... | 1.00 |
| 11 a. m | 26.17 | 26.17 | 72.1 | 72.3 | 59 | 63 | 0.09 | ...... | 1.00 |
| Noon | 26.16 | 26.15 | 73.9 | 73.8 | 57 | 61 | 0.17 | T. | 1.00 |
| 1 p. m | 26.14 | 26.13 | 75.2 | 74.8 | 58 | 60 | 0.10 | 0.02 | 1.00 |
| 2 p. m | 26.12 | 26.11 | 74.9 | 74.8 | 57 | 60 | 0.03 | 0.01 | 1.00 |
| 3 p. m | 26.10 | 26.09 | 74.8 | 74.1 | 57 | 62 | 0.28 | 0.02 | 1.67 |
| 4 p. m | 26.09 | 26.08 | 73.2 | 72.4 | 64 | 65 | 0.37 | 0.07 | 1.17 |
| 5 p. m | 26.10 | 26.00 | 70.3 | 70.2 | 67 | 69 | 0.96 | 0.09 | 1.50 |
| 6 p. m | 26.10 | 26.10 | 67.4 | 67.5 | 74 | 75 | ...... | 0.03 | ...... |
| 7 p. m | 26.12 | 26.11 | 65.3 | 65.2 | 80 | 79 | 0.03 | 0.02 | 0.33 |
| 8 p. m | 26.14 | 26.13 | 64.0 | 64.2 | 82 | 82 | 0.10 | 0.04 | 0.48 |
| 9 p. m | 26.16 | 26.14 | 63.3 | 63.7 | 83 | 82 | ...... | T. | ...... |
| 10 p. m | 26.17 | 26.16 | 62.6 | 63.0 | 84 | 82 | 0.03 | 0.02 | 0.50 |
| 11 p. m | 26.17 | 26.16 | 62.0 | 62.5 | 85 | 84 | 0.13 | 0.01 | 1.83 |
| Midnight | 26.17 | 26.16 | 61.6 | 61.9 | 85 | 84 | 0.01 | 0.01 | 0.83 |
| Mean | 26.14 | 26.13 | 65.8 | 65.9 | 75 | 76 | ...... | ...... | ...... |
| Minimum | 26.00 | 25.98 | 52.3 | 49.5 | 39 | ...... | ...... | ...... | ...... |
| Maximum | 26.23 | 26.30 | 81.9 | 86.5 | 100 | ...... | ...... | ...... | ...... |
| Total | ...... | ...... | ...... | ...... | ...... | ...... | 2.47 | 0.41 | 15.32 |

REMARKS.—At San José the barometer is 3,835 feet above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 5 feet above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 5 feet above ground. Since January 1, 1902, observations at San José have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San José local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San José local time; the barometer is 14 feet above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.—*San José, January, 1904.*

| Time. | Sunshine. Observed, 1904. | Sunshine. Normal, 1889-1903. | Cloudiness. Observed, 1904. | Cloudiness. Normal, 1889-1903. | Temperature of the soil at depth of— 6 inches. | 12 inches. | 24 inches. | 48 inches. | 120 inches. |
|---|---|---|---|---|---|---|---|---|---|
| | *Hours.* | *Hours.* | % | % | ° *F.* | ° *F.* | ° *F.* | ° *F.* | ° *F.* |
| 7 a. m | 10.42 | 7.67 | 36 | 39 | 67.3 | 67.8 | 68.7 | 68.6 | 69.6 |
| 8 a. m | 25.10 | 22.19 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 9 a. m | 25.27 | 22.29 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 10 a. m | 24.47 | 20.70 | 49 | 46 | 67.6 | 67.7 | 68.7 | 69.0 | ...... |
| 11 a. m | 22.45 | 19.48 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Noon | 19.75 | 18.25 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 1 p. m | 19.61 | 17.75 | 64 | 54 | 68.4 | 68.0 | 68.7 | 68.9 | ...... |
| 2 p. m | 20.29 | 19.60 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 3 p. m | 19.03 | 19.05 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 4 p. m | 17.63 | 17.37 | 69 | 58 | 69.2 | 68.5 | 68.7 | 68.9 | ...... |
| 5 p. m | 13.93 | 12.78 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 6 p. m | 2.31 | 2.53 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 7 p. m | ...... | ...... | 63 | 55 | 69.3 | 68.7 | 68.8 | 68.7 | ...... |
| 8 p. m | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 9 p. m | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| 10 p. m | ...... | ...... | 63 | 44 | 68.8 | 68.6 | 68.8 | 68.7 | ...... |
| 11 p. m | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Midnight | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Mean | ...... | ...... | 53 | 50 | 68.4 | 68.3 | 68.8 | 68.8 | 69.6 |
| Total | 220.26 | 199.57 | ...... | ...... | ...... | ...... | ...... | ...... | ...... |

TABLE 3.—*Rainfall at stations in Costa Rica, January, 1904.*

| Stations. | Height above sea level. | Observed, 1904. Amount. | Observed, 1904. Number of days. | Averages. Number of years. | Averages. Amount. | Averages. Number of days. |
|---|---|---|---|---|---|---|
| | *Feet.* | *Inches.* | | | *Inches.* | |
| Sipurio (Talamanca) | 197 | 9.65 | 16 | 4 | 13.11 | 18 |
| Boca Banano | 10 | 4.65 | 16 | 8 | 12.80 | 19 |
| Port Limon | 10 | 0.67 | 7 | 10 | 14.33 | 19 |
| Swamp Mouth | 10 | ...... | ...... | 6 | 10.87 | 17 |
| Zent | 66 | 4.96 | 15 | 3 | 15.79 | 17 |
| Siquirres | 197 | ...... | ...... | 6 | 16.06 | 13 |
| Dos Novillos | 400 | ...... | ...... | ...... | ...... | ...... |
| Guapiles | 984 | ...... | ...... | 4 | 12.56 | 17 |
| Cariblanco (Sarapiqui) | 2,740 | 7.60 | 21 | 6 | 20.55 | 22 |
| San Carlos | 528 | 7.87 | 20 | 6 | 9.37 | 17 |
| Las Lomas | 873 | ...... | ...... | 4 | 14.57 | 15 |
| Peralta | 1,089 | ...... | ...... | 6 | 9.37 | 16 |
| Turrialba | 2,034 | ...... | ...... | 9 | 8.86 | 18 |
| Juan Viñas | 3,412 | ...... | ...... | 8 | 8.11 | 12 |
| Santiago | 3,609 | ...... | ...... | 3 | 5.67 | 16 |
| Paraiso | 4,383 | ...... | ...... | 3 | 1.46 | 3 |
| Cachi | 3,346 | 8.11 | 9 | 3 | 7.17 | 20 |
| Las Concavas | 4,386 | 20.71 | 18 | 3 | 6.30 | 19 |
| Cartago | 4,761 | ...... | ...... | 3 | 3.39 | 18 |
| Tres Rios | 4,265 | 2.84 | 6 | 15 | 0.98 | 4 |
| San Francisco Guadalupe | 3,894 | 1.89 | 7 | 8 | 0.67 | 4 |
| San José | 3,806 | 2.48 | 8 | 15 | 0.55 | 3 |
| La Verbena | 3,740 | 13.31 | 11 | 8 | 1.26 | 4 |
| Nuestro Amo | 2,595 | 0.20 | 2 | 8 | 2.48 | 2 |
| Alajuela | 3,117 | ...... | ...... | 4 | ...... | ...... |
| San Isidro Alajuela | 4,416 | 1.30 | 2 | 3 | ...... | ...... |
| Las Cañas | 2,559 | ...... | ...... | ...... | ...... | ...... |

TABLE 4.—*Observations taken at Port Limon and Zent, January, 1904.*

| Stations. | Pressure. Minimum. | Pressure. Maximum. | Pressure. Mean. | Temperature. Minimum. | Temperature. Maximum. | Temperature. Mean. | Relative humidity. |
|---|---|---|---|---|---|---|---|
| | *Inches.* | *Inches.* | *Inches.* | ° *F.* | ° *F.* | ° *F.* | % |
| Port Limon | 29.64 | 29.95 | 29.77 | ...... | ...... | ...... | ...... |
| Zent | ...... | ...... | ...... | 67.1 | 88.5 | 77.4 | 86 |

| Stations. | Cloudiness. | Sunshine. | Rainfall. Amount. | Rainfall. Number of days. | Temperature of soil at depth of— 6 inches. | 12 inches. | 24 inches. |
|---|---|---|---|---|---|---|---|
| | % | *Hours.* | *Inches.* | | ° *F.* | ° *F.* | ° *F.* |
| Port Limon | ...... | ...... | 0.67 | 7 | ...... | ...... | ...... |
| Zent | 66 | 172.10 | 4.96 | 15 | 76.6 | 77.9 | 77.2 |

## MEXICAN CLIMATOLOGICAL DATA.

By Señor MANUEL E. PASTRANA, Director of the Central Meteorologic-Magnetic Observatory.

*January, 1904.*

| Stations. | Altitude. | Mean barometer.* | Temperature. Max. | Temperature. Min. | Temperature. Mean. | Relative humidity. | Precipitation. | Prevailing direction. Wind. | Prevailing direction. Cloud. |
|---|---|---|---|---|---|---|---|---|---|
| | *Feet.* | *Inches.* | ° *F.* | ° *F.* | ° *F.* | % | *Ins.* | | |
| Frontera | ...... | 30.10 | 88.5 | 57.2 | 72.3 | ...... | 0.87 | ne, se. | ...... |
| Guadalajara (Obs. del Est.) | 5,186 | 24.95 | 75.2 | 44.6 | 59.7 | 56 | 0.00 | nw. | ...... |
| Guanajuato | 6,640 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Leon (Guanajuato) | 5,899 | 24.31 | 73.8 | 32.7 | 57.2 | 52 | T. | ne, nw. | w. |
| Mazatlan | 25 | 29.96 | 75.0 | 51.1 | 66.7 | 74 | 0.02 | nw. | ...... |
| Merida | 50 | 29.92 | 94.8 | 45.0 | 73.6 | 43 | 0.00 | ne. | ...... |
| Mexico (Obs. Cent.) | 7,472 | 23.12 | 71.2 | 45.5 | 55.8 | 50 | 0.00 | ne. | ...... |
| Mexico (E. N. Agric.) | 7,442 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | sw. |
| Monterey (Seminario) | 1,626 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Morelia (Seminario) | 6,401 | 23.92 | 72.5 | 41.0 | 56.1 | 53 | 0.00 | s. | ...... |
| Pachuca | 7,959 | 22.54 | 73.4 | 45.0 | 51.4 | 61 | 0.00 | ne. | ...... |
| Parral | 5,676 | 24.52 | 71.2 | 14.7 | 47.7 | ...... | 0.08 | w. | ...... |
| Puebla (Col. Cath.) | 7,108 | 23.35 | 73.6 | 37.0 | 55.0 | 63 | 0.00 | ne. sw. | ...... |
| Puebla (Col. d Est.) | 7,118 | 23.32 | 74.8 | 34.7 | 53.4 | 57 | 0.00 | ne. | ...... |
| Queretario | 6,070 | 24.13 | 76.1 | 41.0 | 57.9 | 45 | T. | e. | ...... |
| San Juan, Bantista | ...... | 29.99 | 81.3 | 64.0 | 73.2 | 83 | 2.56 | ne. | ...... |
| Vera Cruz | 40 | 29.99 | 80.6 | 57.6 | 70.7 | 84 | 1.46 | ...... | ...... |
| Zacatecas | 8,015 | 22.51 | 70.2 | 40.1 | 53.2 | 46 | 0.00 | w. | ...... |
| Zapotlan | 5,078 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |

*The monthly barometric means are reduced to the international standard of gravity.

Chart I. Tracks of Centers of High Areas. January, 1904.

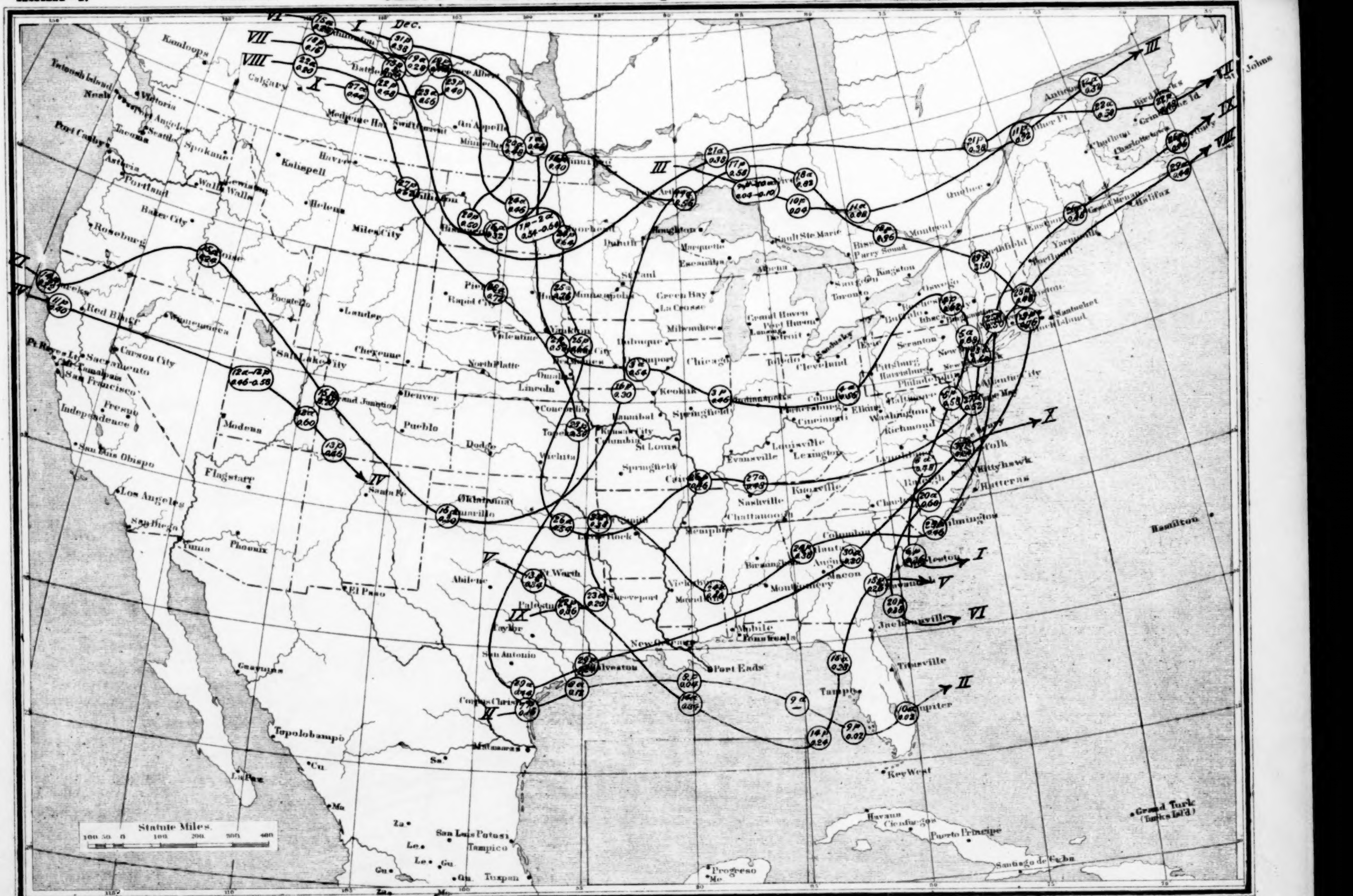


Chart II. Tracks of Centers of Low Areas. January, 1904.

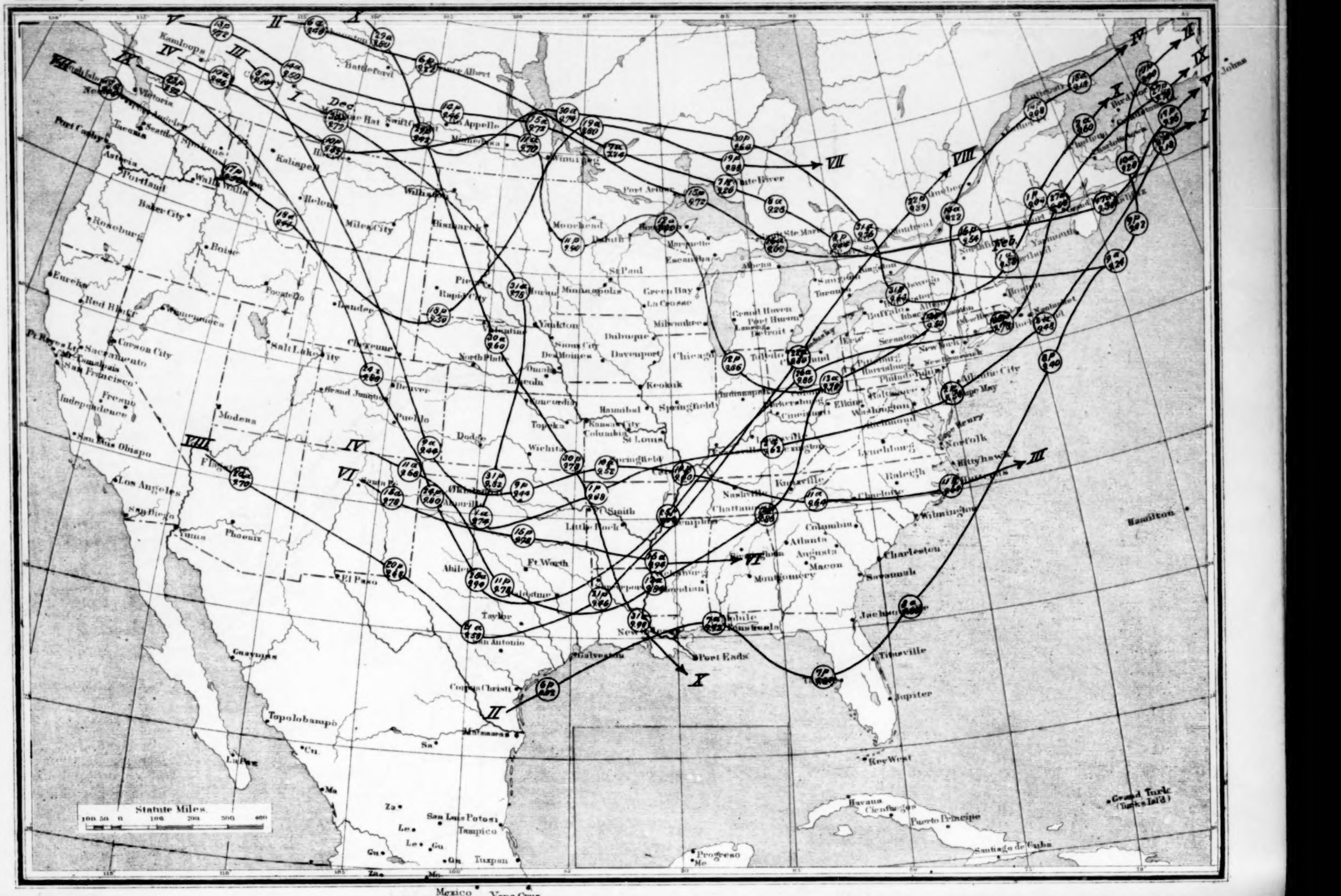
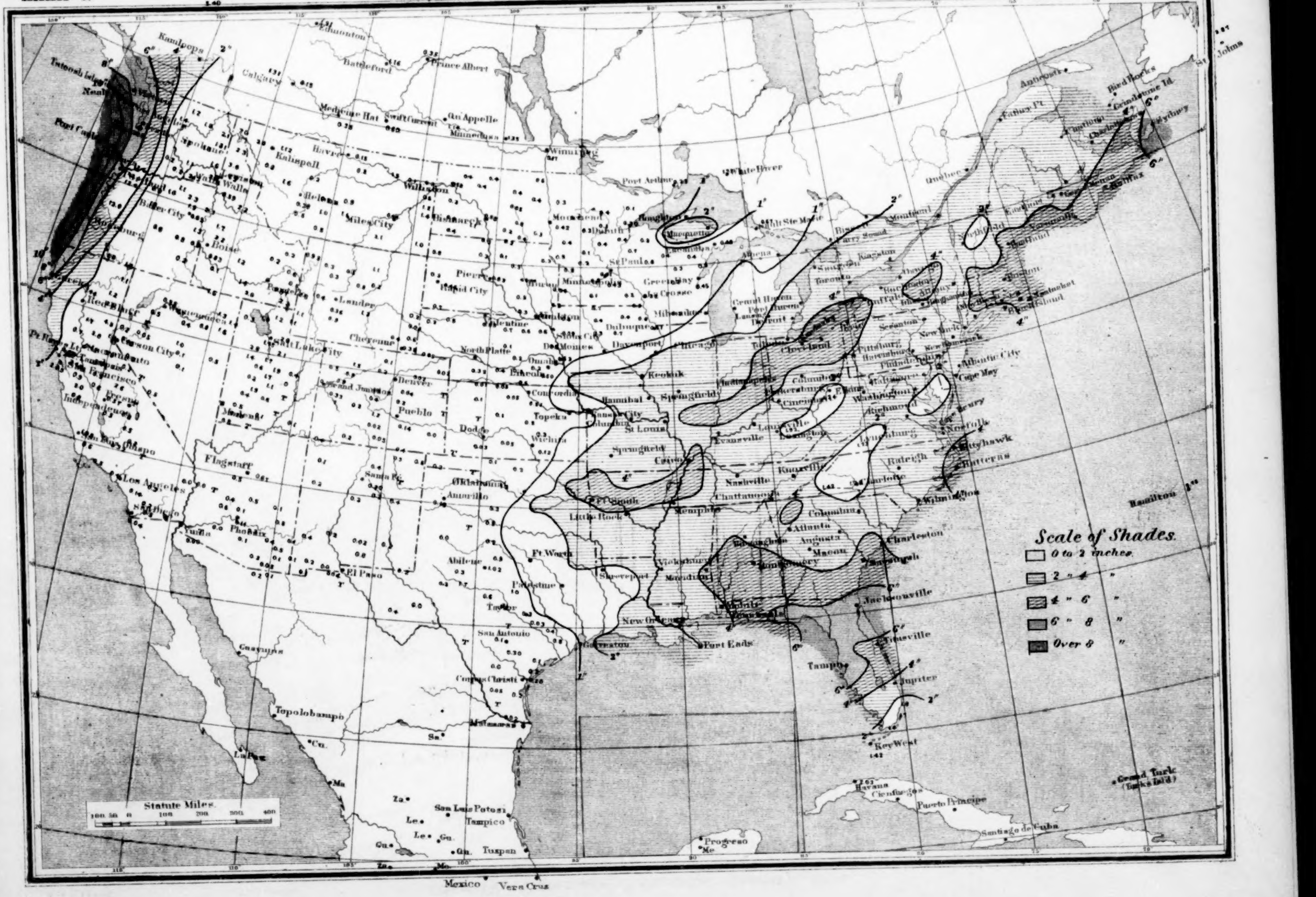


Chart III. Total Precipitation. January, 1904.



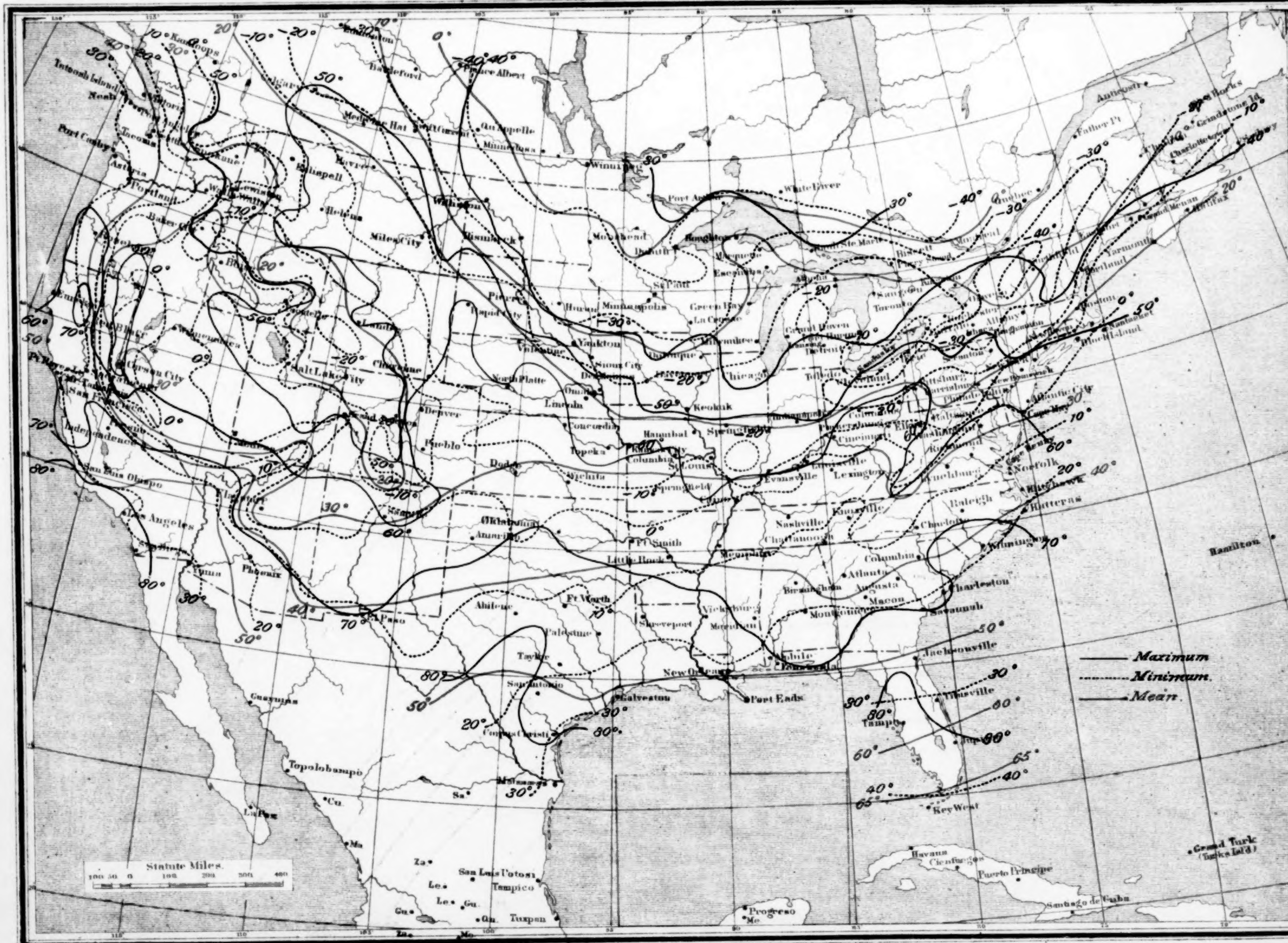
• Barkerville

# Chart IV. Percentage of Sunshine. January, 1904.



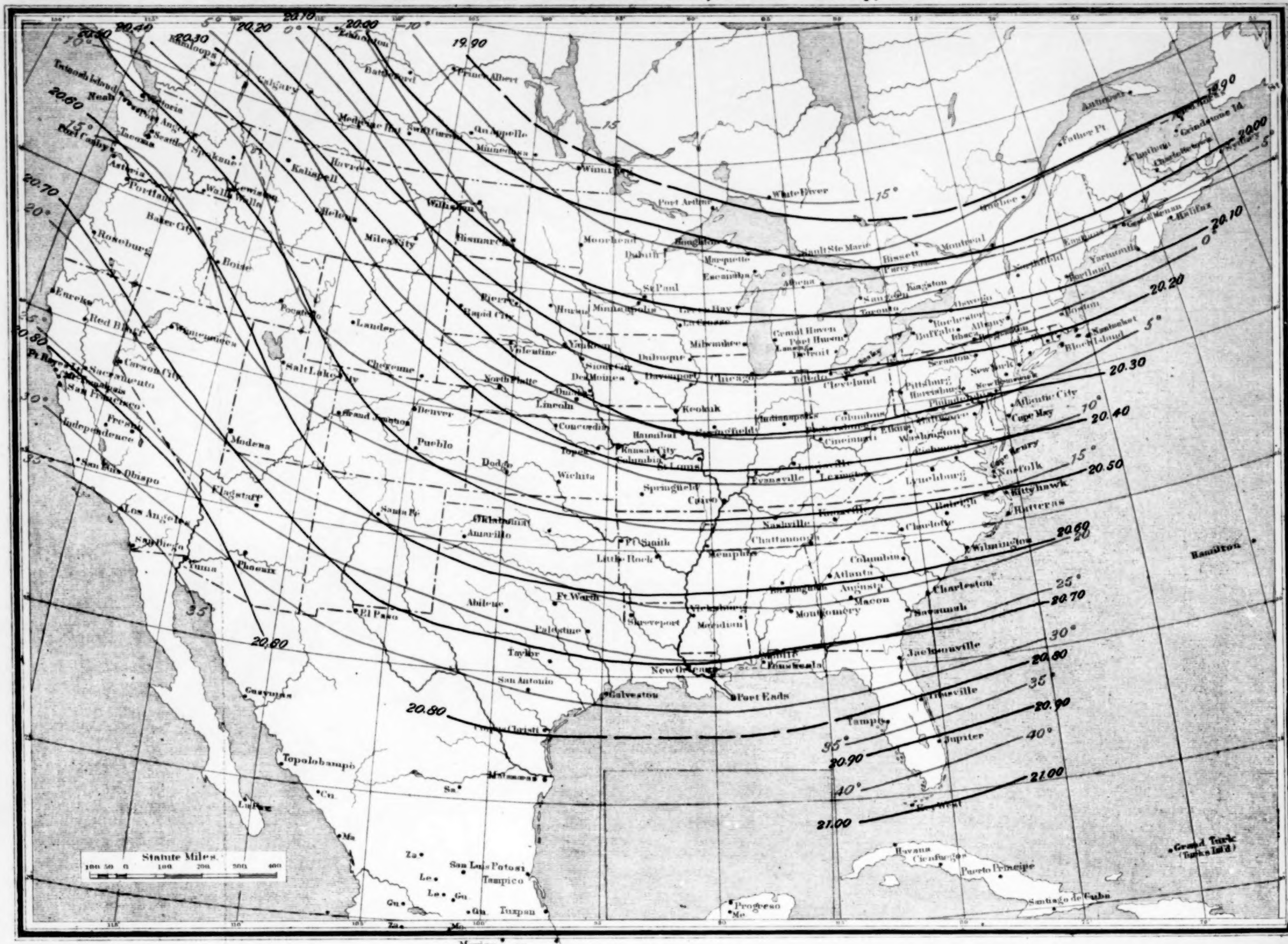

• Barkerville Chart V. Surface Temperatures: Maximum, Minimum, and Mean. January, 1904.

## Chart V. Surface Temperatures; Maximum, Minimum, and Mean. January, 1904.



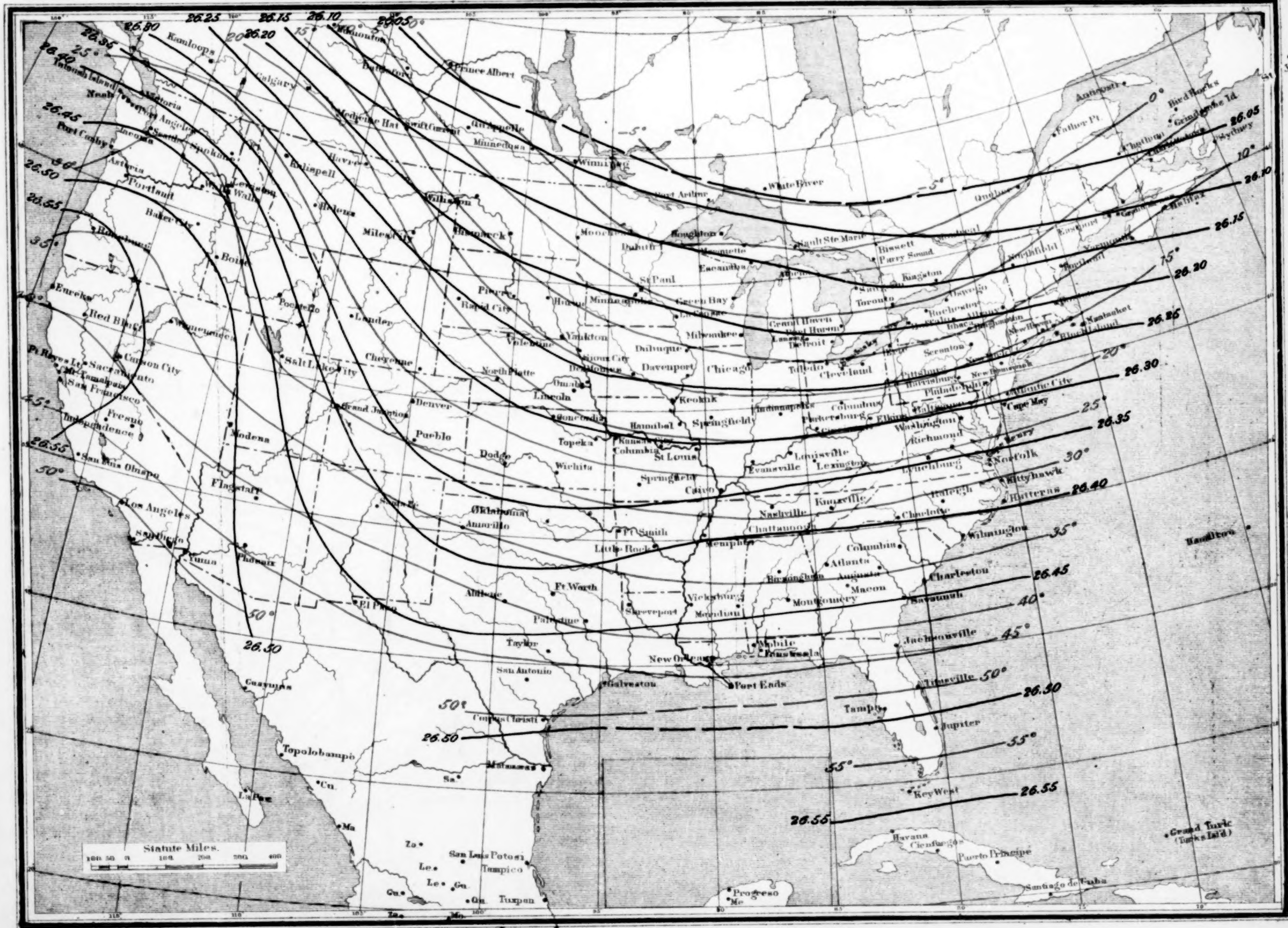
• Barkerville

## Chart VI. Isobars and Isotherms at 10,000 feet. January, 1904.




XXXII—7 • Barkerville Chart VII. Isobars and Isotherms at 3500 feet. January, 1904.

## Chart VII. Isobars and Isotherms at 3500 feet. January, 1904.




Mexico Vera Cruz

Chart VIII. Isobars and Isotherms at Sea Level; Resultant Surface Winds. January, 1904.




Chart IX. Isobars, Isotherms, and Resultant Winds for the West Indies. January, 1904.

## Chart IX. Isobars, Isotherms, and Resultant Winds for the West Indies. January, 1904.

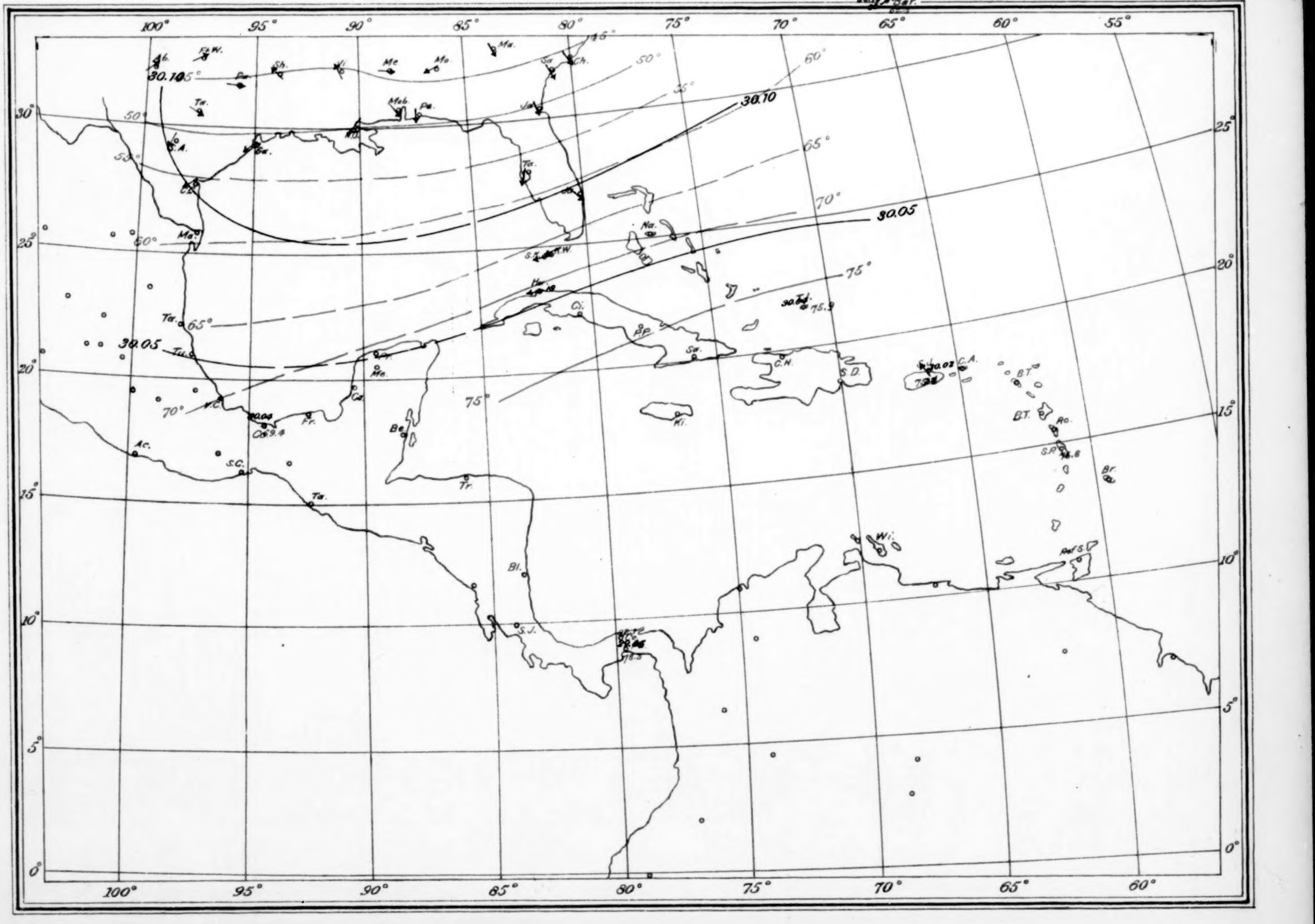
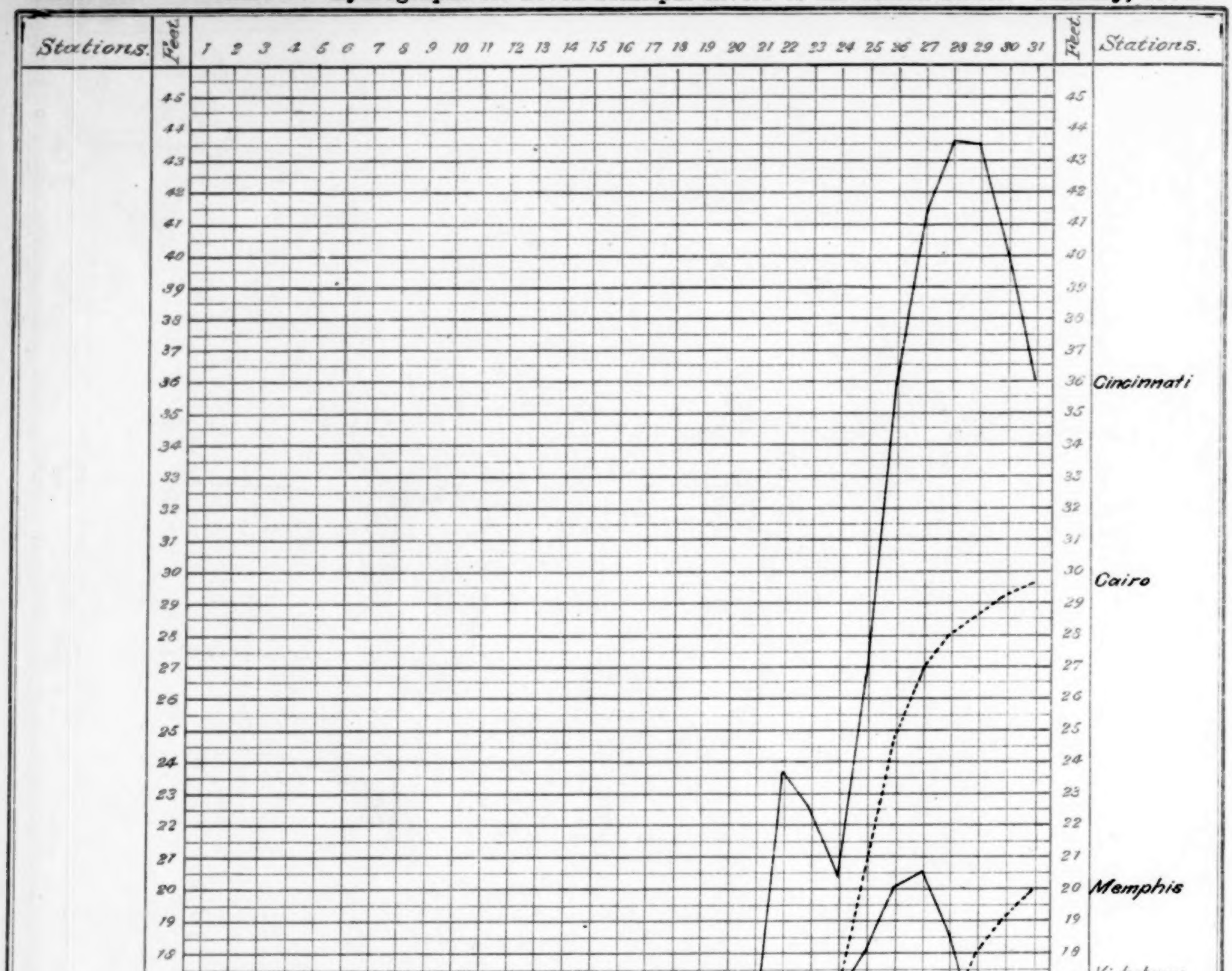


**Chart X. Hydrographs for Seven Principal Rivers of the United States. January, 1904.**



## Chart XI. Total Snowfall. January, 1904.

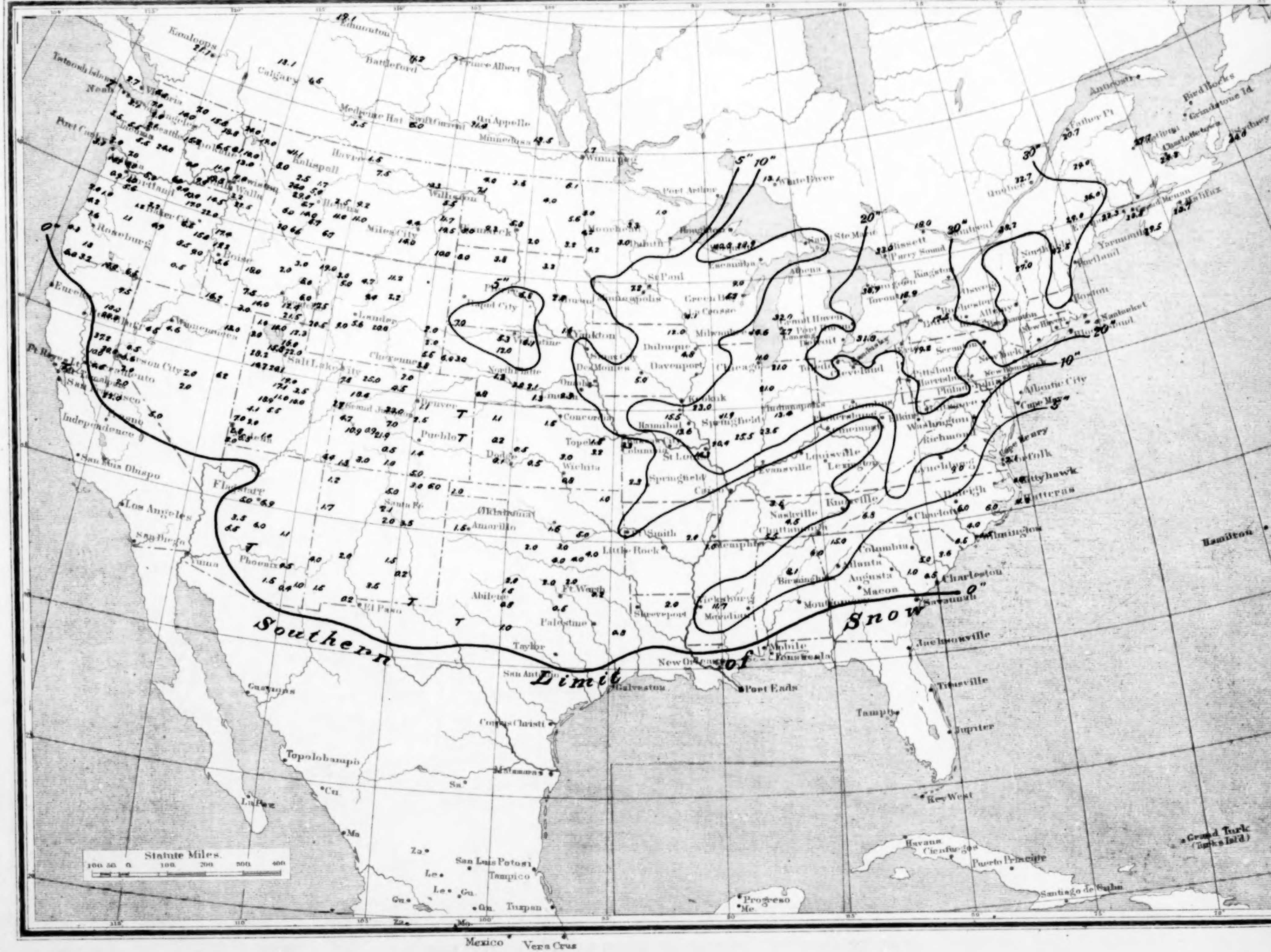


Chart XII. Depth of Snow on Ground. January 31, 1904.